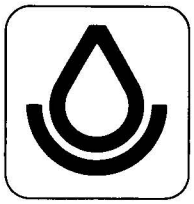
SOIL SURVEY

Hale County, Texas



UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
TEXAS AGRICULTURAL EXPERIMENT STATION
Issued August 1974

Major fieldwork for this soil survey was done in the period 1963–68. Soil names and descriptions were approved in 1969. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1969. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Hale County Soil and Water Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Hale County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside, and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and shows the page on which each soil is described. It also gives the capability unit and range site of each soil.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and ranchers and those who work with them can learn about use and management of the soils from the soil descriptions, from the explanation of the capability grouping, and from the general discussion of range management.

Game managers, sportsmen, and others can find information that is helpful in selecting areas for management as wildlife habitat in the section "Wildlife."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain estimates of soil properties and interpretations of soil properties as they affect engineering practices.

Community planners and others can find in the tables of engineering data information about soil properties that affect the choice of sites for light industrial facilities and for recreation areas.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers to the county may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning and near the end of the publication.

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Contents

Issued August 1974

SOIL SURVEY OF HALE COUNTY, TEXAS

BY EARL R. BLAKELY AND WILLIAM M. KOOS, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION

HALE COUNTY is in the central part of the Southern High Plains in the western part of Texas (fig. 1). It

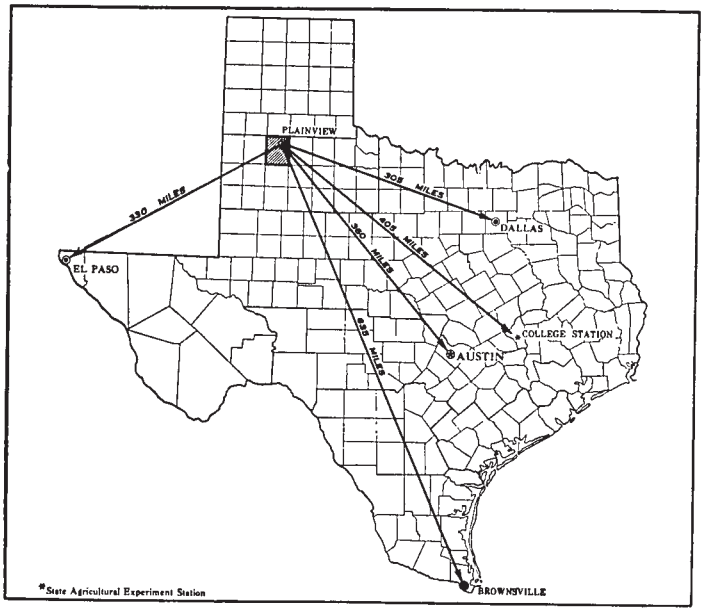

Figure 1.—**Location of Hale County in Texas.**

has a total area of 626,560 acres, or about 979 square miles. Plainview, the county seat, is in the northern part of the county at an elevation of 3,370 feet. Other towns are Hale Center, Abernathy, Petersburg, and Cotton Center.

The primary enterprise of Hale County is farming. About 96 percent of the county is cultivated, and a large part of this is irrigated. The major crops are cotton, grain sorghum, small grain, soybeans, castorbeans, and alfalfa, but a significant amount of vegetables is also grown in the county. One small area of rangeland is in the sandhills region in the western part of the county. The remaining acreage of rangeland is in small tracts scattered across the county. Several large feedlots are in the county, and thousands of beef cattle are fattened each year on the locally grown grain.

The climate of Hale County is that of a dry steppe that has mild winters. The average annual rainfall is 19 inches, and the average frost-free growing season is 211 days. Short periods of drought are common, and in some years dryland crops fail to grow. In other years rainfall is sufficient to obtain favorable production.

Hale County has the typical relief of the High Plains. Most of the county is a smooth, nearly level, almost featureless plain that is interrupted by numerous enclosed depressions. The depressions range in size from less than 5 acres to several hundred acres. The larger depressions are generally deep and include large areas of sloping soils. The bottoms of the depressions are playa lakes that receive runoff water from the surrounding slopes. The topography of the sandhills region in the western part of the county is undulating to duny.

Two streams flow across the county. Running Water Draw flows across the northern part, and the North Fork of the Double Mountain Fork of the Brazos River flows across the southwestern part of the county. These streams are relict drainageways that have cut deeply into the deposits of the High Plains. These streams head in New Mexico, but they flow only during heavy rains. There are a few other less distinct drainageways in the county, but they are not so deeply entrenched and some are not continuous. All of the drainageways flow toward the southeast. The topography of the county slopes to the southeast and has an average grade of about 10 feet per mile.

Hale County is in a mixed prairie region. It is almost treeless, having only a few cottonwood trees along the streams and a few small mesquite trees, sand sagebrush, and cacti on the uplands. The sandhills region supports tall grasses. The rest of the county supports only short or mid grasses.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Hale County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. As they traveled over the county, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with

those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Amarillo and Olton, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Olton loam, 1 to 3 percent slopes, is one of two phases of the Olton series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this survey was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. One such kind of mapping unit shown on the soil map of Hale County is the undifferentiated group.

An undifferentiated group is made of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of a soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. Drake soils, 3 to 8 percent slopes, is an example.

While a soil survey is in progress, data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil, and yields under defined management are estimated for the soils suitable for crops.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, ranchers, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Hale County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The five soil associations in Hale County are each described in the following pages. The texture described in the title of each association is that of the surface layer. For example, the words "clay loams and loams" in the title of association 1 refer to the texture of the surface layer of the dominant soils.

1. Pullman-Olton association

Nearly level to gently sloping, noncalcareous clay loams and loams

Association 1 occurs on a smooth plain that is interrupted by numerous dish-shaped, closed depressions called playas. Some of the depressions are deep and are surrounded by large areas of gently sloping soils. Runoff water is impounded in the playas.

This association occupies about 64 percent of the county. Pullman soils make up about 63 percent of the association; Olton soils, about 21 percent; and minor soils, the remaining 16 percent.

Pullman soils have a surface layer of brown clay loam about 10 inches thick. The next layer is clay about 36 inches thick. It is brown in the upper part and reddish brown in the lower part. Below this, to a depth of about 84 inches, is clay loam that is pink in the upper part and reddish yellow in the lower part.

Olton soils have a surface layer of reddish-brown loam about 14 inches thick. The next layer is clay loam about 28 inches thick. It is reddish brown in the upper part and yellowish red in the lower part. Below this, to a depth of about 72 inches, is clay loam that is pink in the upper part and reddish yellow in the lower part.

Minor soils are those of the Randall, Estacado, Mansker, Drake, Lofton, Zita, Acuff, and Bippus series. These soils occur in and around depressions. Figure 2 shows the major soils in this association as they occur in the landscape.

Most of this association is cultivated. A few small areas are native rangeland, and a few areas that were once cultivated have been reseeded to native grass. Most of the acreage for which water is available is irrigated. The nearly level soils are well suited to surface irrigation. Under dryfarming, production is limited in most years because of the lack of moisture. The hazard of soil blowing is slight, and the hazard of water erosion is slight to moderate. The size of the average farm in this association is about 480 acres.

2. *Pullman association*

Nearly level to gently sloping, noncalcareous clay loams

Association 2 occurs on a smooth, nearly level plain that contains many, dish-shaped, closed depressions called playas. Most of the runoff water is impounded in the depressions.

This association occupies about 18 percent of the county. Pullman soils make up about 80 percent of the association, and minor soils the remaining 20 percent.

Pullman soils extend continuously across the plain. These soils have a surface layer of brown clay loam about 10 inches thick. The next layer is clay about 36 inches thick. It is brown in the upper part and reddish brown in the lower part. Below this, to a depth of about 84 inches, is clay loam that is pink in the upper part and reddish yellow in the lower part.

Minor soils are those of the Randall, Lofton, Olton, Mansker, and Estacado series. Figure 3 shows the major soils in this association as they occur in the landscape.

Most of this association is cultivated, but a few small tracts remain as native rangeland. The soils are well suited to surface irrigation because of the smooth topography, and a large acreage is irrigated. The hazard of soil blowing is slight. The size of the average farm in this association is about 300 acres.

3. *Olton-Amarillo-Acuff association*

Nearly level to gently sloping, noncalcareous loams and fine sandy loams

Association 3 is nearly level to gently sloping and contains numerous, dish-shaped, closed depressions called playas. Runoff water is impounded in the playas.

This association occupies about 12 percent of the county. Olton soils make up about 42 percent of the association; Amarillo soils, about 25 percent; Acuff soils, about 13 percent; and minor soils, the remaining 20 percent.

Olton soils have a surface layer of reddish-brown loam about 14 inches thick. The next layer is clay loam about 28 inches thick. It is reddish brown in the upper part and yellowish red in the lower part. Below this, to a depth of 72 inches, is clay loam that is pink in the upper part and reddish yellow in the lower part.

Amarillo soils have a surface layer of reddish-brown fine sandy loam about 8 inches thick. The next layer is reddish-brown sandy clay loam about 18 inches thick. The next lower layer is yellowish-red sandy clay loam about 12 inches thick. Below this, to a depth of about 80 inches, is reddish-yellow sandy clay loam.

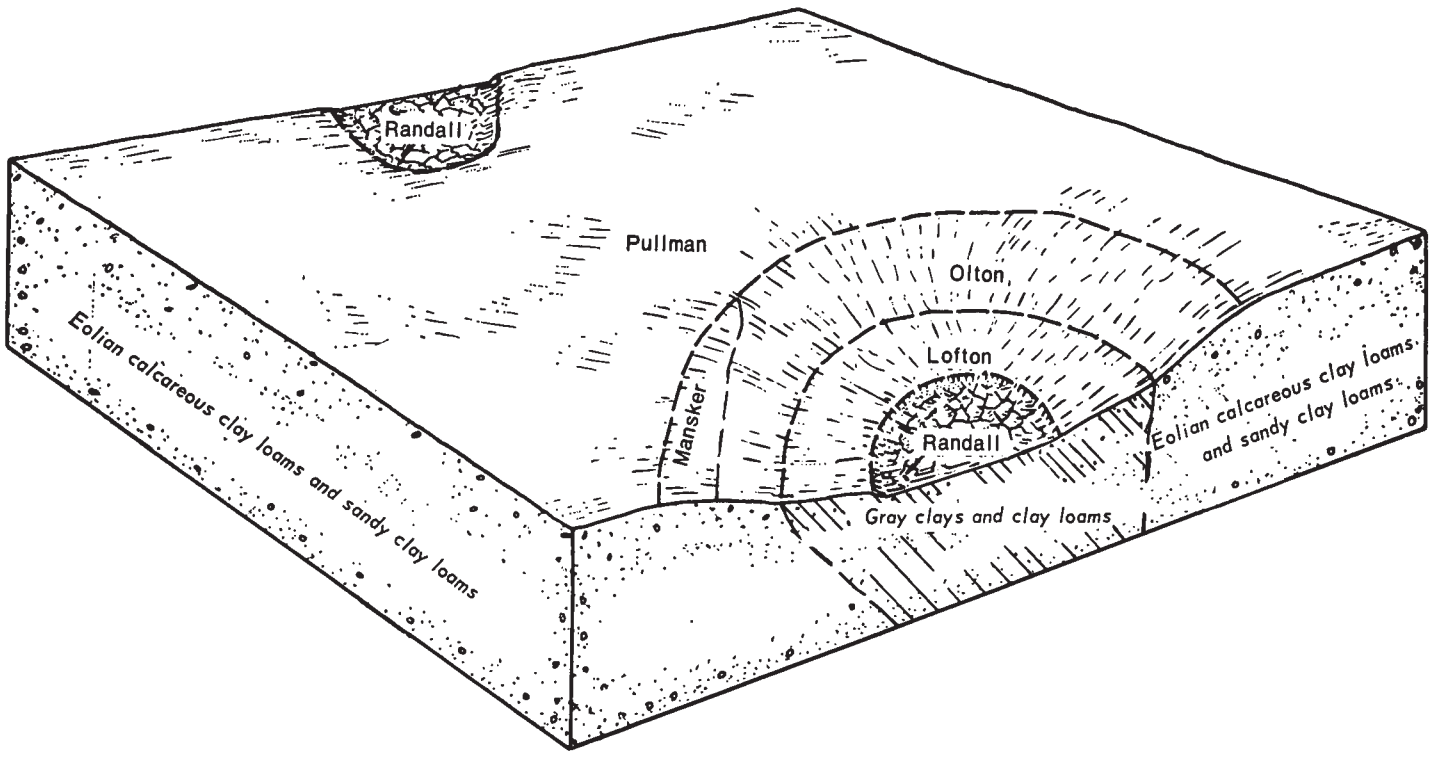

Figure 2.—**Typical pattern of soils and landscape features in association 1.**

Acuff soils have a surface layer of reddish-brown loam about 12 inches thick. The next layer is reddish-brown sandy clay loam about 20 inches thick. The next lower layer is reddish-yellow sandy clay loam about 10 inches thick. Below this, to a depth of 80 inches, is sandy clay loam that is pink in the upper part and reddish yellow in the lower part.

Minor soils are those of the Randall, Drake, Estacado, Mansker, Zita, Posey, and Lofton series. These soils are in small areas throughout the association. Figure 4 shows the major soils in this association as they occur in the landscape.

Most of this association is cultivated. A large acreage is also irrigated. A few small areas are native rangeland, and perennial grasses have been reestablished in a few areas that were once cultivated. The hazards of soil blowing and water erosion are slight to severe on these soils. The size of the average farm in this association is about 320 acres.

4. *Mansker-Bippus-Berda association*

Nearly level to sloping, calcareous loams and fine sandy loams

Association 4 occurs as narrow areas of smooth and nearly level soils on the floors of valleys and as gently sloping to sloping soils on the side slopes above streams. The floors of the valleys are about 100 to 300 feet below the surrounding uplands.

This association occupies about 5 percent of the county. Mansker soils make up about 30 percent of the association; Bippus soils, about 25 percent; Berda soils, about 10 percent; and minor soils, the remaining 35 percent.

Mansker soils have a surface layer of grayish-brown loam about 6 inches thick. The next layer is dark grayish-brown clay loam about 6 inches thick. The next lower layer, about 16 inches thick, is pink clay loam. Below this, to a depth of 60 inches, is reddish-yellow clay loam.

Bippus soils have a surface layer of dark grayish-brown loam about 9 inches thick. The next layer is dark grayish-brown clay loam about 11 inches thick. The next lower layer is brown clay loam about 20 inches thick. Below this, to a depth of 60 inches, is light-brown clay loam. The surface layer of Bippus soils is 15 to 18 inches of fine sandy loam in some places.

Berda soils have a surface layer of brown loam about 7 inches thick. The next layer is brown sandy clay loam about 8 inches thick. The next lower layer is a light brown sandy clay loam about 25 inches thick. Below this, to a depth of 60 inches, is light reddish-brown sandy clay loam.

Minor soils are those of the Lofton, Estacado, Acuff, Olton, Posey, and Potter series.

Most areas of the nearly level to gently sloping soils in the valleys are cultivated. Most areas of the sloping soils are rangeland. Some of the areas are irrigated pasture. The hazards of soil blowing and water erosion are slight to severe. The size of the average farm in this association is about 400 acres.

5. *Brownfield-Tivoli association*

Nearly level to steep, noncalcareous fine sands

Association 5 consists of a small area of deep, sandy soils that are commonly referred to as the sandhills. This area is undulating to duny and is the edge of a large area that extends into the adjoining counties.

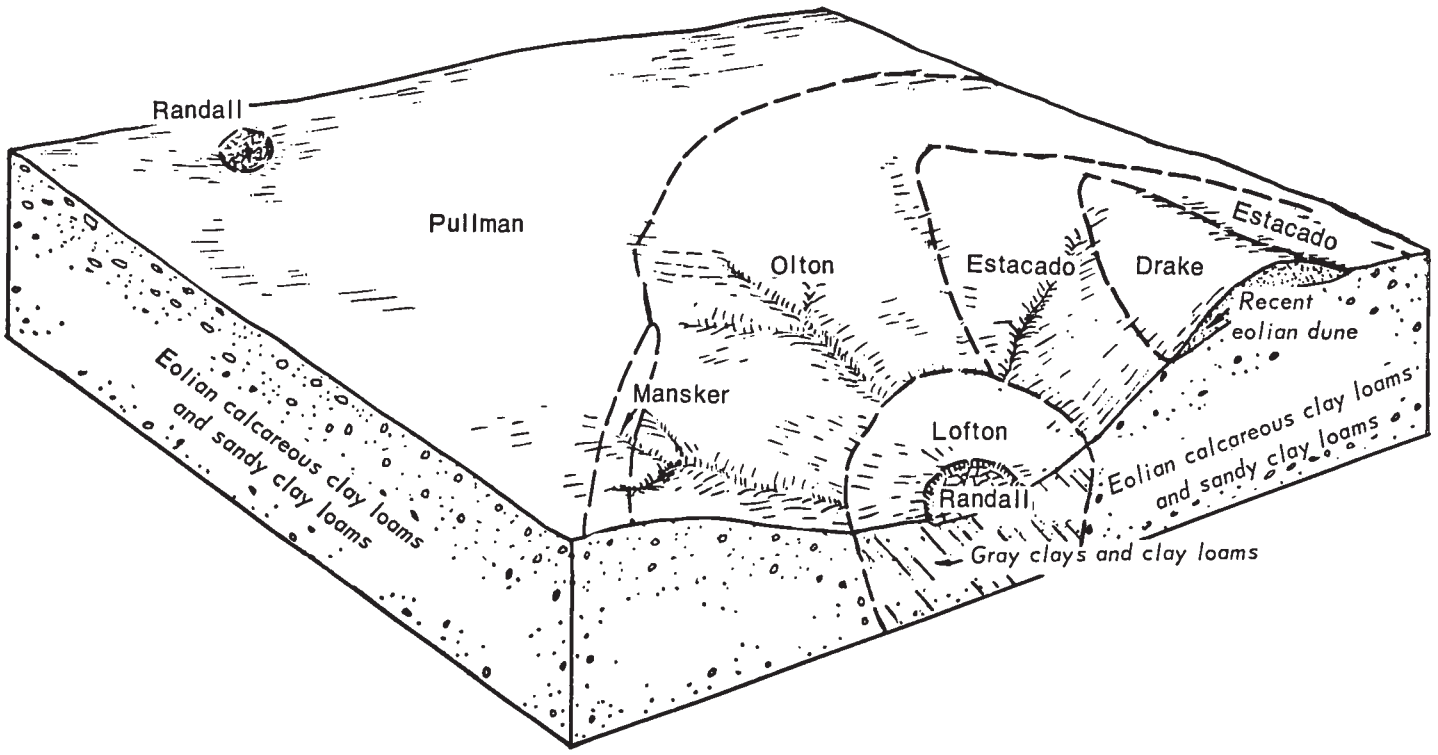

Figure 3.—Typical pattern of soils and landscape features in association 2.

This association occupies less than 1 percent of the county. Brownfield soils make up 39 percent of the association; Tivoli soils, about 25 percent; and minor soils, the remaining 36 percent.

Brownfield soils have a surface layer of fine sand about 26 inches thick. It is brown in the upper part and light brown in the lower part. The next layer is red sandy clay loam about 38 inches thick. Below this, to a depth of 90 inches, is sandy clay loam that is yellowish red in the upper part and reddish yellow in the lower part.

Tivoli soils have a surface layer of pale-brown fine sand about 8 inches thick. The next layer, to a depth of 60 inches, is reddish-yellow fine sand.

Minor soils include those of the Amarillo and Springer series. Figure 5 shows the major soils in this association as they occur in the landscape.

Most of this association is rangeland. Some areas are in pasture, and a few areas are in cultivation. Most of the cropland is irrigated. The hazard of soil blowing is severe. The size of the average farm in this association is about 320 acres.

Descriptions of the Soils

This section describes the soils of Hale County in detail. The procedure is to describe first a soil series and then the mapping units, or kinds of soil, in that series. Thus, to get full information on any one mapping unit, it is necessary to read both the description of that unit and the description of the soil series to which the unit belongs.

Each soil series description contains a short narrative description of a profile considered representative for the series, and a much more detailed description of the same profile that scientists, engineers, and others can use in making highly technical interpretations. The colors described are for dry soil, unless otherwise noted.

Suggestions concerning use and management of each soil as cropland and information pertinent to range management are given in the description of each mapping unit.[1]

Some of the terms used in the soil descriptions are defined in the Glossary, some in the section "How This Survey Was Made," and some in the "Soil Survey Manual" (*6*).[2] The approximate acreage and proportionate extent of each soil mapped are shown in table 1. At the back of this soil survey is the "Guide to Mapping Units," which lists the mapping units in the county and shows the capability unit (irrigated, nonirrigated, or both) and range site in which each mapping unit has been placed.

[1] Information on use and management of cropland prepared by ALLEN H. KING, conservation agronomist, Soil Conservation Service; information on range management and on vegetation suited to each soil prepared by JOE B. NORRIS, range conservationist, Soil Conservation Service.

[2] Italic numbers in parentheses refer to Literature Cited, page 52.

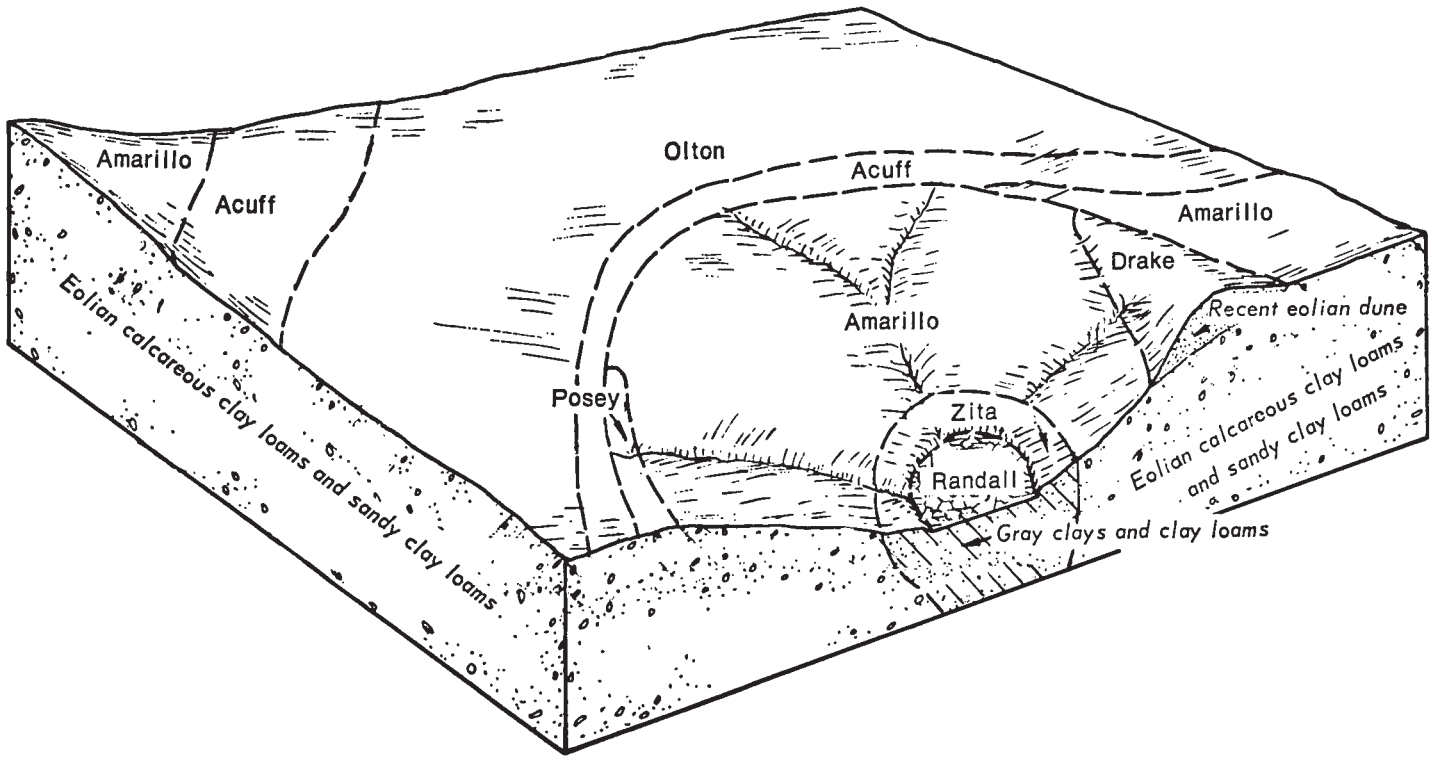

Figure 4.—**Typical pattern of soils and landscape features in association 3.**

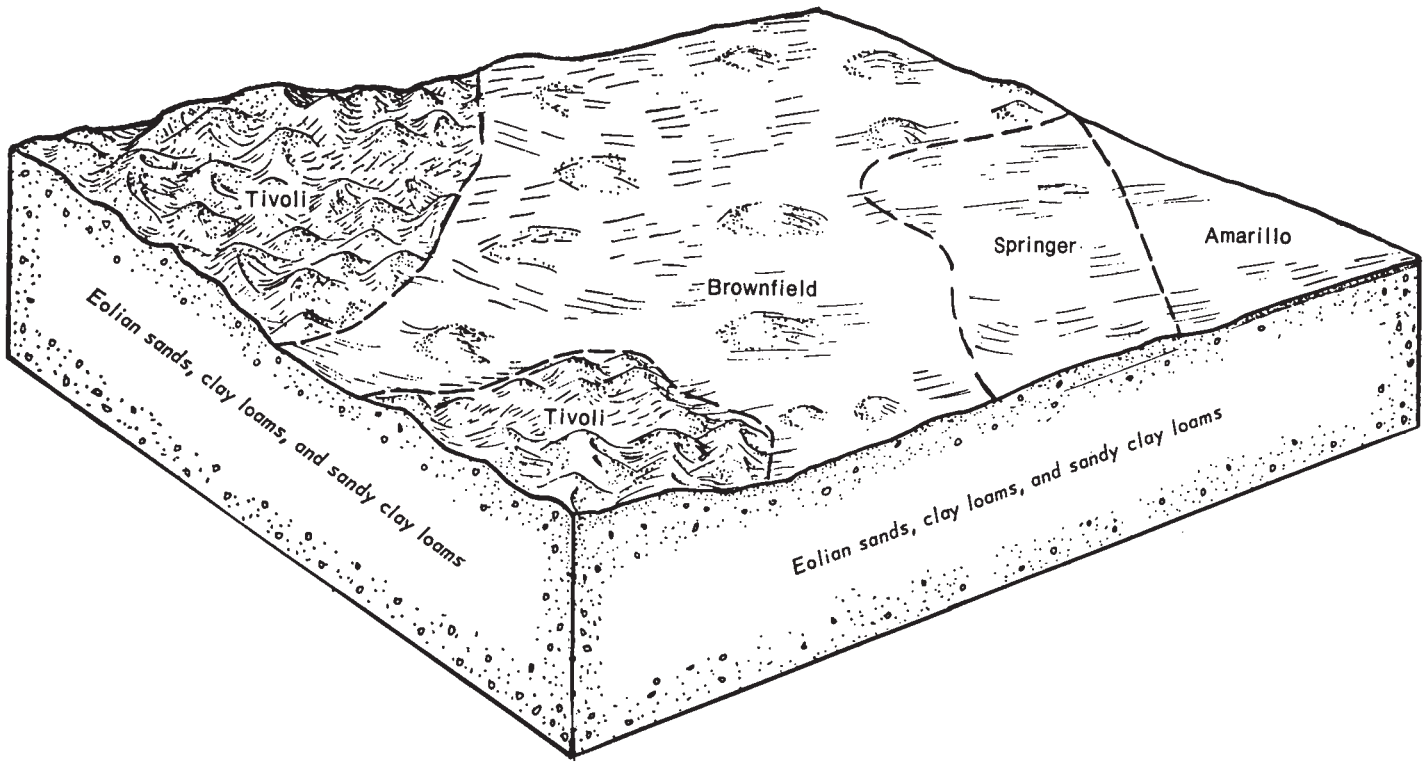

Figure 5.—**Typical pattern of soils and landscape features in association 5.**

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Acuff loam, 0 to 1 percent slopes	3, 748	0. 6	Lofton clay loam	27, 991	4. 5
Acuff loam, 1 to 3 percent slopes	10, 145	1. 6	Mansker loam, 0 to 3 percent slopes	8, 220	1. 3
Amarillo fine sandy loam, 0 to 1 percent slopes	6, 518	1. 0	Mansker loam, 3 to 5 percent slopes	6, 329	1. 0
Amarillo fine sandy loam, 1 to 3 percent slopes	12, 092	1. 9	Midessa fine sandy loam, 0 to 1 percent slopes	327	(1)
Amarillo fine sandy loam, 3 to 5 percent slopes	1, 424	. 2	Midessa fine sandy loam, 1 to 3 percent slopes	633	. 1
Amarillo loamy fine sand, 0 to 3 percent slopes	926	. 1	Olton loam, 0 to 1 percent slopes	84, 596	13. 5
Arch loam, 0 to 3 percent slopes	1, 280	. 2	Olton loam, 1 to 3 percent slopes	40, 904	6. 5
Berda loam, 3 to 5 percent slopes	2, 600	. 4	Posey fine sandy loam, 0 to 3 percent slopes	445	(1)
Berda loam, 5 to 8 percent slopes	1, 058	. 2	Posey fine sandy loam, 3 to 5 percent slopes	466	(1)
Bippus fine sandy loam, overwash, 0 to 1 percent slopes	485	(1)	Potter gravelly loam	340	(1)
			Pullman clay loam, 0 to 1 percent slopes	333, 590	53. 2
Bippus fine sandy loam, overwash, 1 to 3 percent slopes	535	(1)	Pullman clay loam, 1 to 3 percent slopes	10, 446	1. 7
			Randall clay	25, 113	4. 0
Bippus loam, 0 to 1 percent slopes	7, 434	1. 2	Springer loamy fine sand, 0 to 3 percent slopes	320	(1)
Bippus loam, 1 to 3 percent slopes	1, 238	. 2	Tivoli fine sand	1, 016	. 2
Brownfield fine sand	1, 553	. 2	Zita loam, 0 to 1 percent slopes	2, 744	. 4
Drake clay loam, 1 to 3 percent slopes	1, 097	. 2	Zita loam, 1 to 3 percent slopes	1, 313	. 2
Drake soils, 3 to 8 percent slopes	2, 856	. 5			
Estacado loam, 0 to 1 percent slopes	11, 155	1. 8	Total	626, 560	100. 0
Estacado loam, 1 to 3 percent slopes	15, 623	2. 5			

[1] Less than 0.1 percent.

Acuff Series

The Acuff series consists of deep, nearly level to gently sloping loams that are on upland plains, around playa lakes, and along draws. These soils formed in loamy, calcareous, eolian material.

In a representative profile (fig. 6), the surface layer is mildly alkaline, reddish-brown loam about 12 inches thick. The next layer, about 20 inches thick, is reddish-brown, friable sandy clay loam that is calcareous in the lower part. The next lower layer is reddish-yellow sandy clay loam about 10 inches thick. The next lower layer, about 14 inches thick, is pink sandy clay loam; about 45 percent of this layer consists of soft lumps and concretions of lime. Below this, to a depth of about 80 inches,

is reddish-yellow sandy clay loam; this layer is 5 to 10 percent soft lumps of lime.

Acuff soils are well drained and are moderately permeable. They have a high available water capacity. Slopes are less than 3 percent.

Most of the acreage of Acuff soils is cultivated. Many areas are irrigated. A few small areas are native rangeland.

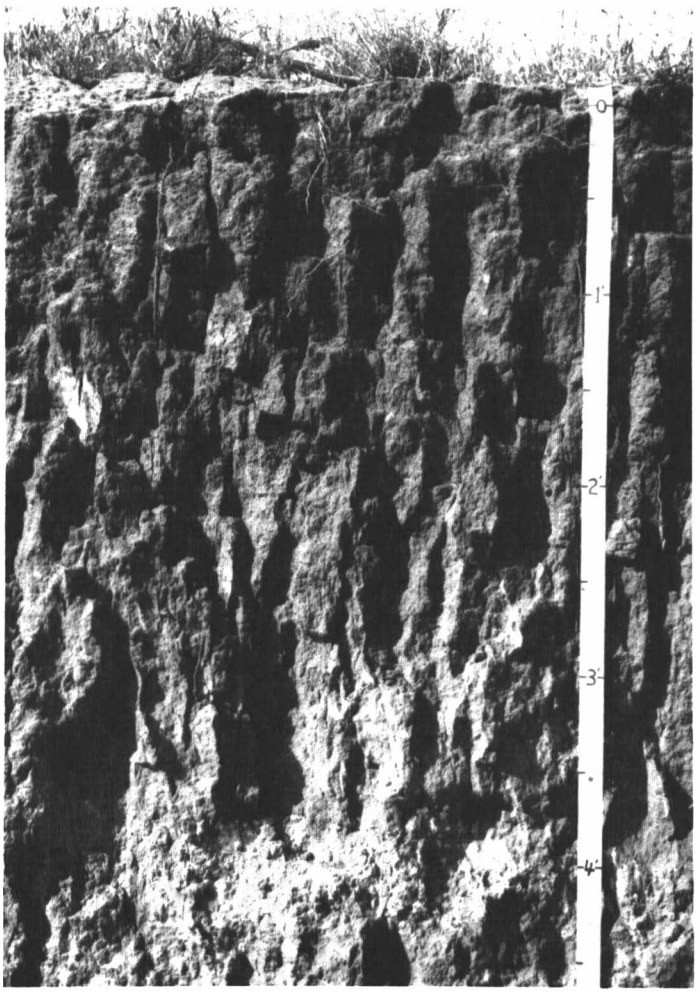

Figure 6.—**Profile of Acuff loam, 1 to 3 percent slopes. Prismatic structure is typical. Calcic horizon is at a depth of about 4 feet.**

Representative profile of Acuff loam, 1 to 3 percent slopes, 2.5 miles north on Farm Road 594 from intersection of Farm Road 54, 4.45 miles west on county road, and 200 feet north into field.

Ap—0 to 12 inches, reddish-brown (5YR 5/3) loam, dark reddish brown (5YR 3/3) when moist; weak, medium, granular structure; hard, very friable; mildly alkaline; abrupt, smooth boundary.

B21t—12 to 24 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) when moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; very hard, friable; many pores and worm casts; thin, patchy clay films; mildly alkaline; gradual, smooth boundary.

B22t—24 to 32 inches, reddish-brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) when moist; weak, very coarse, prismatic structure parting to moderate, medium, subangular blocky; very hard, friable; few threads and films of calcium carbonate; many very fine pores; thin, patchy clay films; calcareous; moderately alkaline; gradual, smooth boundary.

B23t—32 to 42 inches, reddish-yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) when moist; weak, coarse, prismatic structure; hard, friable; few films, threads, and soft masses of calcium carbonate; patchy clay films and bridged sand grains; calcareous; moderately alkaline; clear, wavy boundary.

B24tca—42 to 56 inches, pink (5YR 7/4) sandy clay loam, light reddish brown (5YR 6/4) when moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; hard, friable; many soft lumps and concretions of calcium carbonate, totaling about 45 percent of the soil mass; calcareous; moderately alkaline; diffuse, wavy boundary.

B25t—56 to 80 inches, reddish-yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 4/6) when moist; weak, coarse, prismatic and moderate, medium, subangular blocky structure; hard, friable; few soft lumps of calcium carbonate, totaling about 5 or 10 percent of the mass; distinct clay films on ped surfaces; bridged sand grains; few pores; calcareous; moderately alkaline.

The A horizon ranges from 10 to 14 inches in thickness and from brown to reddish brown in color. In the upper part of the B2t horizon, the texture is sandy clay loam or clay loam, and the color is red, reddish brown, or reddish yellow. Clay films in this part of the profile are patchy in some places and continuous in others. The B24tca horizon begins at a depth of 30 to 60 inches. It is pink, light reddish brown, or reddish yellow. The calcium carbonate content of this horizon ranges from 15 to 60 percent; most of the calcium carbonate is soft and powdery. The B25t horizon is red or reddish yellow and is clay loam or sandy clay loam. The calcium carbonate content of this horizon ranges from 5 to 20 percent; most of the calcium carbonate is soft and powdery.

Acuff loam, 0 to 1 percent slopes (AcA).—This soil occupies a smooth plain. Slope averages about 0.5 percent and is slightly convex. Most areas are long and narrow in shape and as much as several hundred acres in size.

The surface layer is reddish-brown loam about 10 inches thick. The next layer is reddish-brown sandy clay loam about 30 inches thick. The next lower layer is pink sandy clay loam about 16 inches thick. Below this, to a depth of about 80 inches, is reddish-yellow sandy clay loam.

Included with this soil in mapping are areas of Olton and Amarillo soils. These inclusions are less than 10 acres in size.

Most of this soil is cultivated, and most cultivated areas are irrigated. Cotton, wheat, grain sorghum, and soybeans are the main crops. The hazards of soil blowing and water erosion are slight.

If this soil is irrigated, good management consists mainly of the use of fertilizer, careful management of irrigation water, and the return of adequate amounts of crop residue. If this soil is dryfarmed, good management consists of leaving crop residue on the surface for protection against soil blowing and water erosion, timely and limited tillage, and use of terraces, diversions, and grassed waterways. Pastureland and hayland need fertilization, frequent and controlled irrigation, and periods of rest from grazing and mowing.

The dominant climax grasses are buffalograss, blue grama, side-oats grama, and vine-mesquite. If the site is overgrazed, buffalograss becomes more abundant. Most areas of this site are kept in good condition. Depending on variations in rainfall, the total annual production of

air-dry herbage on range in excellent condition is 1,200 to 2,000 pounds per acre. Capability unit IIIe–4, dryland, and IIe–1, irrigated; Deep Hardland range site.

Acuff loam, 1 to 3 percent slopes (AcB).—This soil occupies areas around playa lakes and along draws. The dominant slope is about 1.5 percent. Most areas are irregular in shape and less than 200 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of Olton, Estacado, and Amarillo soils. These inclusions are less than 10 acres in size. Also included were a few areas that have a moderate hazard of water erosion, a few gullies, and a surface layer that is thinner than is normal for this Acuff soil.

Most of this soil is cultivated, but a few areas are in native rangeland. Most of the cultivated areas are irrigated. Wheat, grain sorghum, and cotton are the main crops. The hazard of soil blowing is slight.

Good management is needed to reduce the hazard of water erosion. In places terraces, diversions, or waterways are needed. Management of crop residue on the surface or mulching with cotton burrs and timely and limited tillage are effective practices. If this soil is irrigated, a properly designed irrigation system, good water management, and fertilization are needed.

The dominant climax grasses are buffalograss, blue grama, side-oats grama, and vine-mesquite. If this site is overgrazed, buffalograss becomes more abundant. Most areas of this site are kept in good condition. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is 1,200 to 2,000 pounds per acre. Capability unit IIIe–2, dryland, and IIIe–2, irrigated; Deep Hardland range site.

Amarillo Series

The Amarillo series consists of deep, nearly level to gently sloping fine sandy loams and loamy fine sands that are on upland ridges, around playa lakes, and along draws. These soils formed in loamy, calcareous, eolian material.

In a representative profile (fig. 7), the surface layer is reddish-brown fine sandy loam about 8 inches thick. The next layer, about 30 inches thick, is friable sandy clay loam that is reddish brown in the upper part and yellowish red in the lower part. The next lower layer, about 16 inches thick, is reddish-yellow sandy clay loam; about 40 percent of this layer consists of soft masses and concretions of lime. Below this, to a depth of about 80 inches, is reddish-yellow sandy clay loam; this layer is 10 percent masses of soft, powdery lime.

Amarillo soils are well drained and are moderately permeable. They have a high available water capacity. Slopes are convex and less than 5 percent.

Most areas of Amarillo soils in Hale County are cultivated. Many areas are irrigated. A few are in irrigated pasture. Small, scattered areas of more steeply sloping soils remain in rangeland.

Representative profile of Amarillo fine sandy loam, 1 to 3 percent slopes, 1.0 mile north of county line, 5.4 miles east on county road, and 100 feet north into field

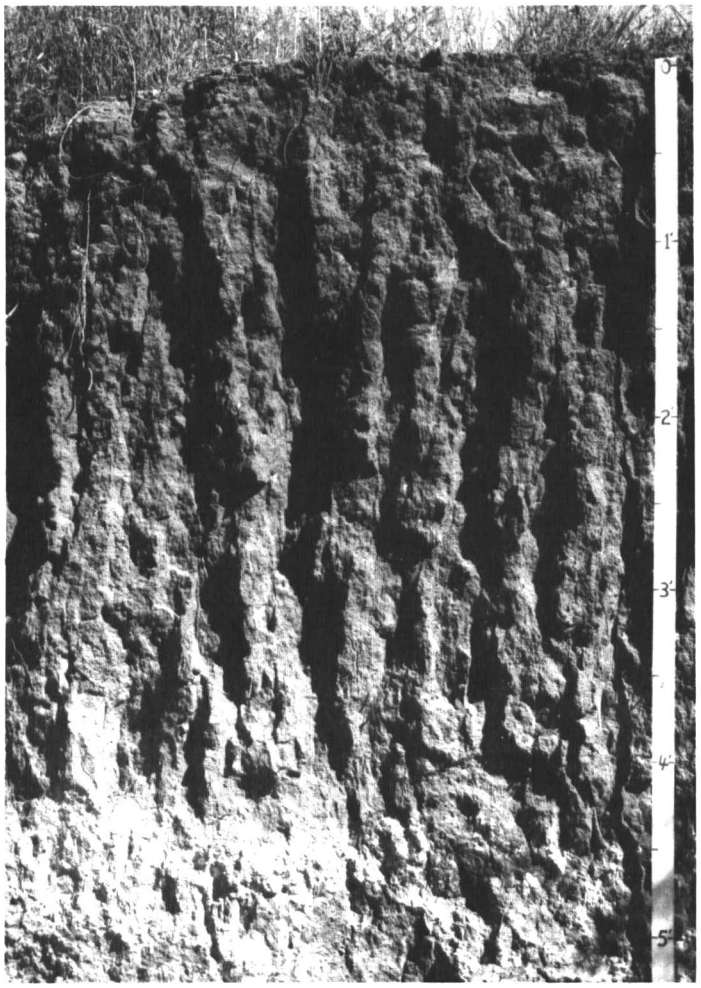

Figure 7.—**Profile of Amarillo fine sandy loam, 1 to 3 percent slopes. The subsoil has prismatic structure and extends to a depth of more than 66 inches.**

(0.1 mile east of southwest corner of section 17, block X, HE&WT Railroad Survey):

Ap—0 to 8 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) when moist; weak, fine, granular structure; hard, very friable; neutral; abrupt, smooth boundary.

B21t—8 to 26 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) when moist; moderate, coarse, prismatic structure parting to weak, medium, subangular blocky; very hard, friable; many fine to medium pores; many worm casts; thin patchy clay films on peds; mildly alkaline; gradual, wavy boundary.

B22t—26 to 38 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; hard, friable; few threads and films of calcium carbonate; many fine to medium pores; patchy clay films on peds; bridged sand grains; noncalcareous; moderately alkaline; gradual, wavy boundary.

B23tca—38 to 54 inches, reddish-yellow (5YR 7/6) sandy clay loam, yellowish red (5YR 5/6) when moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; hard, friable; about 40 percent of soil mass consists of many soft masses and concretions of calcium carbonate; few patchy clay films on peds; calcareous; moderately alkaline; diffuse, wavy boundary.

B24t—54 to 80 inches, reddish-yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) when moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; about 10 percent soft powdery lime; distinct thin clay films on peds; few pores and root channels; calcareous; moderately alkaline.

The A horizon ranges from 7 to 16 inches in thickness, from fine sandy loam to loamy fine sand in texture, and from brown to reddish brown in color. Reaction is neutral to mildly alkaline. The Bt horizon ranges from sandy clay loam to clay loam. The upper 20 inches of the Bt horizon has a clay content of 25 to 35 percent. The part of the Bt horizon above the B23tca horizon ranges from red to reddish brown, yellowish red, or reddish yellow. Depth to the B23tca horizon is 30 to 60 inches. The calcium carbonate content of this horizon ranges from 15 to 50 percent. The B23tca horizon ranges from pink to reddish yellow. The Bt horizon below the B23tca horizon ranges from red to reddish yellow. The content of segregated calcium carbonate ranges from a few visible films and threads to 10 percent or more in soft, powdery masses.

Amarillo loamy fine sand, 0 to 3 percent slopes (AlB).—This soil is on uplands. Slope averages about 0.8 percent. Most areas are less than 100 acres in size.

The surface layer is brown loamy fine sand about 14 inches thick. The next layer is reddish-brown sandy clay loam about 26 inches thick. Below this layer is about 12 inches of reddish-yellow sandy clay loam; about 25 percent of this layer consists of soft masses and concretions of lime. Below this is reddish-yellow sandy clay loam; about 10 percent of this layer consists of soft masses of lime.

Included with this soil in mapping are areas of Springer and Brownfield soils and a few areas where the surface layer is fine sandy loam. These inclusions are scattered and are less than 10 acres in size.

Most of this soil is cultivated, and most areas are irrigated. Cotton, grain sorghum, forage sorghum, and bermudagrass are common crops. The hazard of soil blowing is severe. Most areas have been deep plowed to help control soil blowing. Deep plowing turns up sandy clay loam soil material that makes the surface layer more cloddy. Runoff is slow.

Management of crop residue reduces soil blowing, and modifying the texture of the surface layer by deep plowing is needed in some places to help control blowing. Use of crop rotations, use of fertilizer, and minimum tillage are effective practices. Terraces, diversion terraces, or waterways are needed in places. If this soil is irrigated, a properly designed system of sprinkler irrigation is needed, as well as good management of irrigation water. Irrigated pasture needs rotation grazing, use of fertilizer, and good water management.

This soil supports many kinds of desirable plants, and tall grasses are dominant if the site is in good condition. The dominant climax grasses are indiangrass, switchgrass, sand bluestem, little bluestem, and sand lovegrass. Other important grasses are giant dropseed, side-oats grama, sand dropseed, three-awn, silver bluestem, blue grama, and hairy grama. Among the plants that invade if the site is overgrazed are windmillgrass, lovegrass, yucca, sand sagebrush, skunkbrush, shin oak, ragweed, and annuals. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is 1,500 to 2,400 pounds per acre. Capability unit IVe–5, dryland, and IIIe–5, irrigated; Sandyland range site.

Amarillo fine sandy loam, 0 to 1 percent slopes (AmA).—This soil occupies broad, smooth, slightly convex areas. The dominant slope is about 0.5 percent. The areas range up to 500 acres in size, and most are irregular in shape.

The surface layer is reddish-brown fine sandy loam about 12 inches thick. The next layer, about 38 inches thick, is sandy clay loam that is reddish brown in the upper part and yellowish red in the lower part. The next layer, about 14 inches thick, is reddish-yellow sandy clay loam; about 30 percent of this layer is soft masses and concretions of lime. Below this, and extending to a depth of about 80 inches, is reddish-yellow sandy clay loam that is about 5 percent soft masses of lime.

Included with this soil in mapping are areas of Acuff and Olton soils. Also included are a few areas of soils that have a loamy fine sand surface layer and a few areas of soils that have dark, buried, clay layers at depths of 30 to 60 inches. These inclusions are less than 10 acres in size.

This soil is well suited both to dryland farming and to farming with sprinkler irrigation. Most areas are cultivated. Cotton, grain sorghum, small grain, and soybeans are the common crops. The hazard of soil blowing is moderate.

Good management consists mainly of leaving crop residue on the surface when crops are not being grown, timely and limited tillage, use of a suitable crop rotation, and fertilization. If this soil is irrigated, a properly designed irrigation system and good water management are needed. Terraces, diversion terraces and waterways are needed to reduce runoff water in some areas.

The dominant climax grasses are side-oats grama, blue grama, little bluestem, Arizona cottontop, and plains bristlegrass. If the site is overgrazed, side-oats grama begins to die out. Plants that invade are mesquite, yucca, catclaw, and annual grasses. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is 1,400 to 2,400 pounds per acre. Capability unit IIIe–3, dryland, and IIe–2, irrigated; Sandy Loam range site.

Amarillo fine sandy loam, 1 to 3 percent slopes (AmB).—This soil occupies areas around playa lakes and along draws. The dominant slope is about 1.8 percent. Most areas are irregular in shape and 20 to 300 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of Acuff, Posey, and Olton soils. These inclusions are less than 10 acres in size. Also included are a few areas where the surface layer is loamy fine sand and a few eroded areas that contain shallow, crossable gullies and where the surface layer is thinnner than is normal for this soil.

Most areas of this soil are cultivated and most of these areas are irrigated. Cotton and grain sorghum are the main crops. The hazards of soil blowing and water erosion are moderate.

Terraces, diversions, and contour farming are needed to control water erosion. Crop residue properly managed on the surface helps to reduce erosion and conserve moisture. Also needed are fertilizer, a suitable crop rotation,

and timely and limited tillage. If this soil is irrigated, a properly planned irrigation system and good water management are needed.

The dominant climax grasses are side-oats grama, blue grama, little bluestem, Arizona cottontop, and plains bristlegrass. If this site is overgrazed, side-oats grama begins to die out. Plants that invade are mesquite, yucca, catclaw, and annual grasses. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is 1,400 to 2,400 pounds per acre. Capability unit IIIe–3, dryland, and IIIe–3, irrigated; Sandy Loam range site.

Amarillo fine sandy loam, 3 to 5 percent slopes (AmC).—This soil occupies small, scattered areas around some of the deeper playa lakes. Slope is mainly 3 to 4 percent. The areas range from 10 to 30 acres in size. Some of the areas have shallow gullies about 100 to 500 feet apart.

The surface layer is reddish-brown fine sandy loam about 8 inches thick. The next layer is yellowish-red sandy clay loam about 24 inches thick. The next lower layer, about 12 inches thick, is pink sandy clay loam; about 35 percent of this layer consists of soft masses and concretions of lime. Below this is a layer of yellowish-red sandy clay loam that is about 15 percent soft masses of lime.

Included with this soil in mapping are areas of Acuff and Posey soils. Also included are a few areas that contain gullies and where the surface layer is thinner than is normal for this soil.

Most of this soil is cultivated and a few areas are irrigated. Small grain and sorghum are the principal crops. A few areas are in native rangeland. The hazard of water erosion is severe, and that of soil blowing is moderate.

Good management is needed on this soil to control water erosion. Closely spaced, high-residue crops provide adequate cover and residue to protect the soil. The residue is most effective if it is managed on the surface and if tillage is kept to a minimum. Terracing and contour farming are needed to reduce water runoff, and grassed waterways and diversions are needed in some areas. Additions of fertilizer and the proper use of irrigation water in a well-designed system of sprinkler irrigation help to assure a good growth of crops.

The dominant climax grasses are blue grama, side-oats grama, Arizona cottontop, little bluestem, and plains bristlegrass. Other important grasses are buffalograss, sand dropseed, hooded windmillgrass, and silver bluestem. Plants that invade are broom snakeweed, hairy tridens, catclaw, and annuals. Overgrazing has destroyed the original mixture of grasses in many areas. In most areas buffalograss is the dominant species on this soil. Under good management better grasses return to the site. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is 1,400 to 2,400 pounds per acre. Capability unit IVe–3, dryland, and IVe–1, irrigated; Sandy Loam range site.

Arch Series

The Arch series consists of nearly level to gently sloping soils that are shallow to moderately deep to a layer that is high in content of lime. These soils formed in chalky, calcareous material that was probably calcified by a shallow ground water table.

In a representative profile (fig. 8), the surface layer is light brownish-gray loam about 14 inches thick. The next layer is light-gray friable clay loam about 18 inches thick. Below this, to a depth of 60 inches, is clay loam.

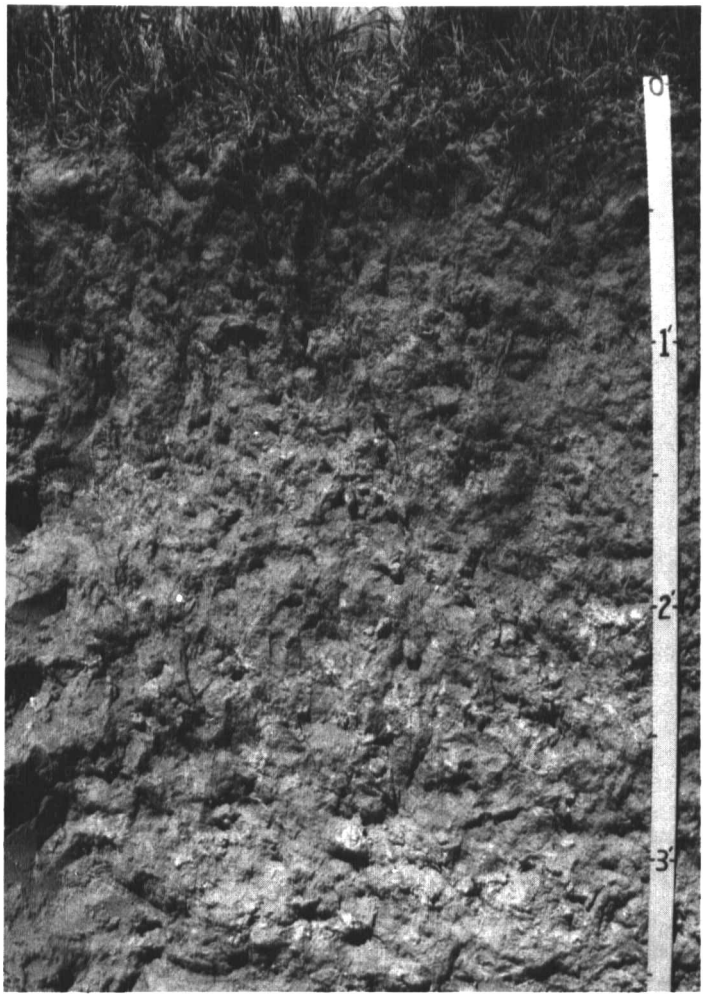

Figure 8.—**Profile of Arch loam, 0 to 3 percent slopes, in native vegetation.**

It is white and contains many threads, films, and soft masses of lime in the upper part and is light gray and contains a few films, threads, and soft masses of lime in the lower part.

Arch soils are moderately well drained and moderately permeable. The hazard of soil blowing is severe. Slope is less than 3 percent.

Most areas of Arch soils are cultivated. A few areas are in native rangeland.

Representative profile of Arch loam, 0 to 3 percent slopes, 0.5 mile west and 0.2 mile south of the northeast corner of section 22, block JE, EL&RR Railroad Survey:

Ap—0 to 14 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, medium, granular structure; hard, friable; calcareous; moderately alkaline; abrupt, smooth boundary.

B2—14 to 32 inches, light-gray (10YR 7/2) clay loam, grayish brown (10YR 5/2) when moist; weak, medium, subangular blocky structure; very hard, friable; about 40 percent calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

C1ca—32 to 48 inches, white (10YR 8/2) clay loam, light gray (10YR 7/2) when moist; massive (structureless); very hard, friable; few snail shells; about 50 percent calcium carbonate; many visible threads, films, and soft masses of calcium carbonate; gradual, wavy boundary.

C2—48 to 60 inches, light-gray (10YR 7/2) clay loam, light brownish gray (10YR 6/2) when moist; massive (structureless); about 40 percent calcium carbonate; few visible films, threads, and soft masses of calcium carbonate.

The content of clay between depths of 10 and 40 inches ranges from 30 to 42 percent. The A horizon ranges from 7 to 14 inches in thickness and from light brownish gray to grayish brown in color. The B horizon ranges from light gray to light brownish gray. The C1ca horizon begins at a depth of 15 to 38 inches. It ranges from white to very pale brown. The calcium carbonate content of this horizon ranges from 35 to 60 percent.

Arch loam, 0 to 3 percent slopes (ArB).—This soil mainly occupies basins of the larger playa lakes, which are just above Randall soils. The dominant slope ranges from 0.5 to 1.5 percent. The areas range from 10 to 40 acres in size and are irregular in shape.

Included with this soil in mapping are areas of Mansker, Estacado, and Drake soils. These inclusions are less than 5 acres in size.

The main crops are small grain, cotton, and sorghum. Some areas are in bermudagrass pasture. In places the high lime content of this soil causes a deficiency of some plant nutrients, such as iron, as indicated by chlorosis or yellowing of leaves on sorghums grown on this soil. This soil has a moderate available water capacity. The hazard of soil blowing is severe.

Good management of cropland is needed to control erosion. Effective practices consist of growing sorghum and small grain crops that produce adequate residue in the rotation and leaving the residue on the surface through the critical periods of erosion and soil blowing. Also needed are proper fertilization of crops and careful application of irrigation water using a properly designed system. In places diversions, terraces, and grassed waterways are needed to control erosion and dispose of excess runoff water.

Good management of pasture grasses consists of the proper and timely use of water and fertilizer, including trace elements if needed.

The dominant climax grasses are blue grama, side-oats grama, vine-mesquite, and plains bristlegrass. Other important grasses are buffalograss, black grama, and sand dropseed. Plants that invade are sand muhly, inland saltgrass, broomweed, and annual grasses. Depending on variations in rainfall, the average annual production of air-dry herbage on range in excellent condition is about 1,000 to 1,600 pounds per acre. Capability unit IVe–1, dryland, and IIIe–4, irrigated; High Lime range site.

Berda Series

The Berda series consists of deep, gently sloping to sloping loams that formed in calcareous, loamy local materials along the major draws.

In a representative profile (fig. 9), the surface layer is brown loam about 7 inches thick. The next layer is brown, very friable sandy clay loam about 8 inches thick. The next lower layer is light-brown, friable sandy clay loam about 25 inches thick. Below this, to a depth of 60 inches, is light reddish-brown sandy clay loam.

Berda soils are excessively drained and are moderately permeable. Runoff is high. They have a high available water capacity.

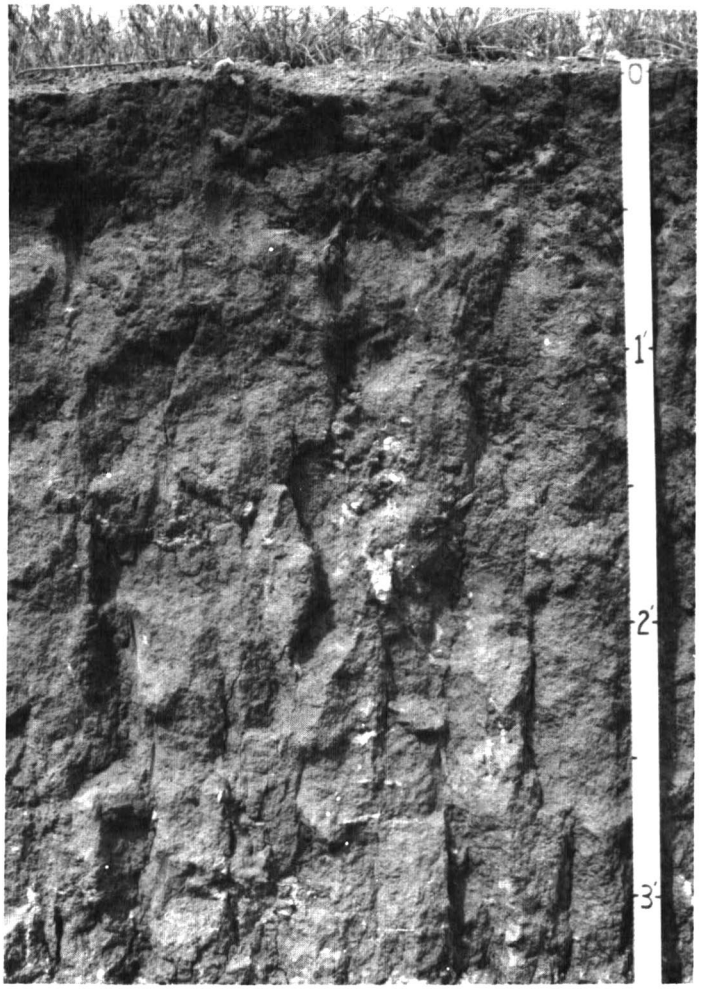

Figure 9.—**Profile of Berda loam, 3 to 5 percent slopes. Prismatic structure below the surface layer is typical.**

About one-half of the acreage of Berda soils is cultivated. Most of the more steeply sloping areas are in native rangeland. Some of the areas that were once cultivated have been returned to native vegetation.

Representative profile of Berda loam, 3 to 5 percent slopes, 1.0 mile northwest of Edmonson on State Route 194, 3.0 miles west on county road, and 0.5 mile south and 50 feet west into field.

Ap—0 to 7 inches, brown (10YR 5/3) loam, dark brown (10YR 4/3) when moist; weak, fine, granular structure; hard, very friable; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—7 to 15 inches, brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) when moist; weak, coarse, prismatic structure; hard, very friable; many pores and worm casts; calcareous; moderately alkaline; gradual, wavy boundary.

B2—15 to 40 inches, light-brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) when moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; very hard, friable; common threads and films of calcium carbonate; few, fine calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

C—40 to 60 inches, light reddish-brown (5YR 6/4) sandy clay loam, reddish brown (5YR 5/4) when moist; massive structureless); hard, very friable; few threads, films, and concretions of calcium carbonate making up about 3 percent of the soil mass; calcareous; moderately alkaline.

The A horizon ranges from 7 to 15 inches in thickness and is brown or grayish brown in color. The B2 horizon is loam, sandy clay loam, or clay loam and is light brown, reddish brown, yellowish red, brown, or light brownish gray. The content of calcium carbonate in this horizon ranges from barely visible films and threads to 4 percent in soft masses and concretions. The C horizon is fine sandy loam, clay loam, or sandy clay loam and is light reddish brown or reddish yellow. The content of visible calcium carbonate ranges from 3 to 8 percent. The clay content between depths of 10 and 40 inches averages about 20 to 30 percent in most areas.

Berda loam, 3 to 5 percent slopes (BeC).—This soil occupies narrow, elongated areas that are parallel to the streams. The dominant slope is about 4 percent. Most areas are less than 200 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of Bippus, Estacado, Mansker, Posey, and Amarillo soils. These inclusions are less than 10 acres in size. Also included are a few areas of eroded soils. These areas have shallow gullies across them, and the surface layer is thinner than is normal for this soil.

The main crops are forage sorghum, grain sorghum, and small grain. This soil is suited to perennial grasses. The hazard of water erosion is severe.

Intensive management is needed to reduce the hazard of water erosion. Terracing, contour farming, and managing crop residue on the surface are effective measures. Diversions and waterways are needed in some places to carry off excess water. A properly designed system of sprinkler irrigation is needed in the irrigated areas.

The dominant climax grasses are side-oats grama, blue grama, vine-mesquite, Arizona cottontop, and plains bristlegrass. Other important grasses are buffalograss, hairy grama, and black grama. Plants that invade are catclaw, broom snakeweed, three-awn, sand dropseed, and annual grasses. Depending on variations in rainfall, the average annual production of air-dry herbage on range in excellent condition is about 1,200 to 2,200 pounds per acre. Capability unit IVe–6 dryland, and IVe–3, irrigated; Hardland Slopes range site.

Berda loam, 5 to 8 percent slopes (BeD).—This soil occupies narrow, elongated areas that are parallel to the streams. The dominant slope is 5 or 6 percent. Most areas are less than 300 acres in size.

The surface layer is brown loam about 12 inches thick. The next layer is light-brown, friable sandy clay loam about 24 inches thick. Below this, to a depth of 60 inches, is light reddish-brown sandy clay loam.

Included with this soil in mapping are areas of Posey, Mansker, and Potter soils less than 10 acres in size. Also included are a few moderately eroded areas and shallow gullies along drainageways.

This soil is not well suited to cultivation because of slope, but a few areas are cultivated. The hazard of water erosion is severe. A few gullies are in areas along the drainageways.

The dominant climax grasses are side-oats grama, blue grama, vine-mesquite, and Arizona cottontop. Other important grasses are buffalograss, sand dropseed, hooded windmillgrass, and silver bluestem. Plants that invade are broom snakeweed, hairy tridens, catclaw, and annual grasses. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is about 1,200 to 2,200 pounds per acre. Capability unit VIe–2, dryland; Hardland Slopes range site.

Bippus Series

The Bippus series consists of deep, nearly level to gently sloping loams and fine sandy loams that formed in calcareous alluvium along the flood plains of old relict streams.

In a representative profile (fig. 10), the surface layer is dark grayish-brown loam about 9 inches thick. The next

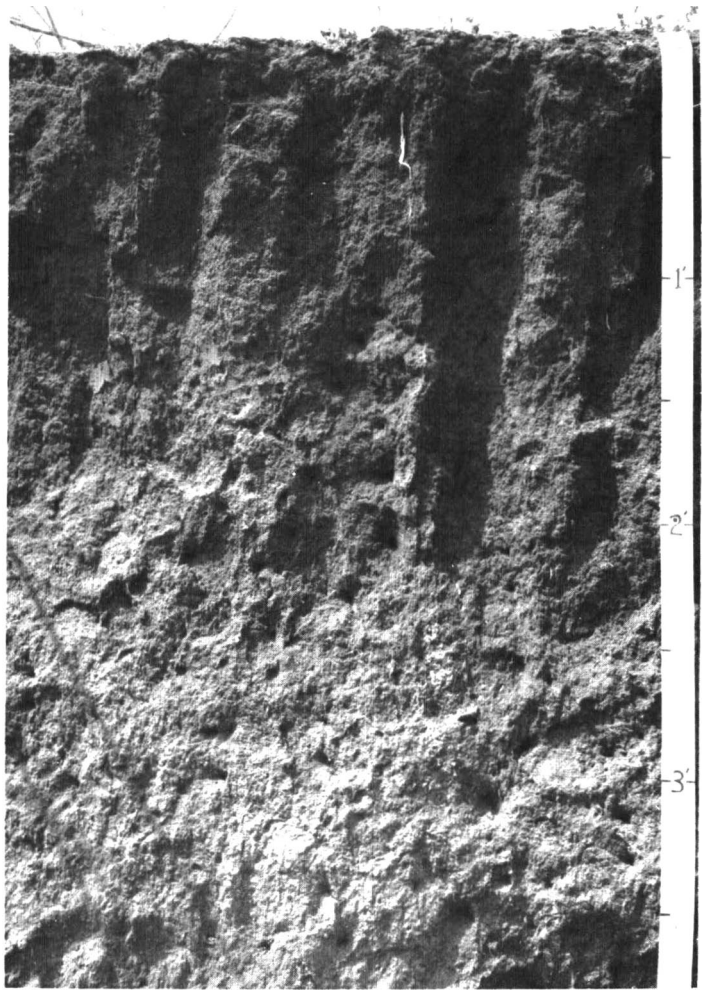

Figure 10.—**Profile of Bippus loam, 0 to 1 percent slopes.**

layer is dark grayish-brown, very friable clay loam about 11 inches thick. The next lower layer is brown, very friable clay loam about 20 inches thick. Below this, to a depth of about 60 inches, is light-brown clay loam.

Bippus soils are moderately permeable. The available water capacity is high. Slopes are less than 3 percent.

Most areas of Bippus soils are cultivated. Many areas are irrigated. They are well suited to dryland farming and irrigated farming.

Representative profile of Bippus loam, 0 to 1 percent slopes, in a cultivated field, 4.1 miles east of the junction of Farm Road 400 and U.S. Highway 70 in Plainview, on U.S. Highway 70, 0.6 mile south on Farm Road 789 and 100 feet east of road:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; weak, fine and medium, granular structure; hard, very friable; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—9 to 20 inches, dark grayish-brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) when moist; weak, medium, granular and weak, medium, subangular blocky structure; hard, very friable; many pores and worm casts; calcareous; moderately alkaline; gradual, smooth boundary.

B21—20 to 40 inches, brown (7.5YR 5/2) clay loam, dark brown (7.5YR 3/2) when moist; weak, medium, granular and weak, fine and medium, subangular blocky structure; hard, very friable; many pores and worm casts; calcareous; moderately alkaline; diffuse, wavy boundary.

B22ca—40 to 60 inches, light-brown (7.5YR 6/3) clay loam, brown (7.5YR 5/3) when moist; weak, fine and medium, subangular blocky structure; some weak stratification noted; hard, very friable; few threads of calcium carbonate; calcareous; moderately alkaline.

The A horizon ranges from 15 to 30 inches in thickness and from clay loam to fine sandy loam in texture. It is dark brown or dark grayish brown. The B21 horizon ranges from loam or sandy clay loam to clay loam in texture and from brown to dark brown in color. The B22ca horizon is loam, sandy clay loam, or clay loam. It is brown, light brown, pale brown, or light gray. The content of calcium carbonate in this horizon ranges from a few visible films and threads to 8 or 10 percent.

Bippus fine sandy loam, overwash, 0 to 1 percent slopes (BfA).—This soil is in smooth valleys along the major streams. The dominant slope is about 0.5 percent. Most areas are narrow and parallel the stream channels. Many areas are subject to occasional flooding of short duration. The areas range from 10 to 100 acres in size. The fine sandy loam layer is an overburden that has washed from the steeper soils above.

The surface layer is dark-brown fine sandy loam about 18 inches thick. The next layer is dark grayish-brown clay loam about 20 inches thick. The next lower layer is brown clay loam about 15 inches thick. Below this, to a depth of about 60 inches, is light-brown clay loam.

Included with this soil in mapping are areas of Bippus loam, 0 to 1 percent slopes.

Most areas of this Bippus soil are cultivated, and a few areas are irrigated. Cotton, grain sorghum, and small grain are the main crops. Most areas receive extra runoff water from soils in higher areas. The available water capacity is high. The hazard of soil blowing is moderate.

Good management consists mainly of leaving residue on the surface when crops are not being grown, timely and limited tillage, and use of a suitable crop rotation. In places terraces, diversions, or waterways are needed. If this soil is irrigated, a properly designed irrigation system, good water management, and fertilization are needed.

The dominant climax grasses are side-oats grama, blue grama, little bluestem, Arizona cottontop, and plains bristlegrass. If the site is overgrazed, side-oats grama begins to die out. Plants that invade are mesquite, yucca, catclaw, and annual grasses. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is 1,400 to 2,400 pounds per acre. Capability unit IIIe–3, dryland, and IIe–2, irrigated; Sandy Loam range site.

Bippus fine sandy loam, overwash, 1 to 3 percent slopes (BfB).—This soil is on the flood plains of main streams. Most areas are less than 50 acres in size. They are narrow and are parallel to the nearly level valleys. The fine sandy loam surface layer is an overburden that has washed from the steeper soils above.

The surface layer is dark-brown fine sandy loam about 15 inches thick. The next layer is brown clay loam about 15 inches thick. The next lower layer is light-brown clay loam about 15 inches thick. Below this is pale-brown clay loam.

Included with this soil in mapping are areas of Bippus loam, 1 to 3 percent slopes, and areas of Amarillo and Berda soils. Also included are a few areas of eroded soils that have gullies 1 to 2 feet in depth. These inclusions are less than 10 acres in size.

Most areas of this soil are cultivated. Cotton and grain sorghum are the main crops. The hazards of soil blowing and water erosion are moderate.

Good management consists of leaving crop residue on the surface, using timely and limited tillage, using a suitable crop rotation, and using terracing and contour farming. If this soil is irrigated, a planned irrigation system, fertilization, and good water management are needed.

The dominant climax grasses are side-oats grama, blue grama, little bluestem, Arizona cottontop, and plains bristlegrass. If the site is overgrazed, side-oats grama begins to die out. Plants that invade are mesquite, yucca, catclaw, and annual grasses. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is 1,400 to 2,400 pounds per acre. Capability unit IIIe–3, dryland, and IIIe–3, irrigated; Sandy Loam range site.

Bippus loam, 0 to 1 percent slopes (BpA).—This soil is on smooth plains in valleys and along streams. The dominant slope is about 0.3 percent. The areas are long and narrow and are parallel to the stream channels. Most areas are several hundred acres in size and are subject to occasional flooding of short duration. This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of stratified soils near stream channels.

Most areas of this soil are cultivated and are irrigated. Cotton, wheat, soybeans, and grain sorghum are the main crops. The hazard of soil blowing is slight.

Effective practices to control erosion are use of a suitable crop rotation, proper use of crop residue, and timely and limited tillage. In irrigated areas, a planned irriga-

tion system, good water management, and fertilization are needed.

The dominant climax grasses are blue grama, side-oats grama, buffalograss, and vine-mesquite. If the site is overgrazed, buffalograss becomes more abundant. Most areas of this soil are kept in good condition. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is 1,500 to 2,400 pounds per acre. Capability unit IIe–1, dryland, and IIe–1, irrigated; Deep Hardland range site.

Bippus loam, 1 to 3 percent slopes (BpB).—This soil occupies areas just above the nearly level plain along the major draws. The areas are narrow in shape, and most are less than 200 acres in size. The dominant slope is 2 percent. This soil is above the flood plain, but it receives extra water from steeper soils.

The surface layer is dark grayish-brown loam about 24 inches thick. The next layer is brown, very friable clay loam about 20 inches thick. Below this, to a depth of about 60 inches, is light-brown clay loam.

Included with this soil in mapping are areas of Berda soils. Also included are a few areas of eroded soils that have gullies.

Most areas of this soil are cultivated. Cotton, wheat, and grain sorghum are the main crops. The hazard of water erosion is moderate.

Good management is needed on this soil to control erosion. Proper use of crop residue and use of a suitable crop rotation help to protect the soil. Terracing and contour farming are also needed. If this soil is irrigated, a properly designed irrigation system, good water management, and fertilization are needed.

The dominant climax grasses are blue grama, side-oats grama, buffalograss, and vine-mesquite. If the site is overgrazed, buffalograss becomes more abundant. Most areas of this soil are kept in good condition. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is 1,500 to 2,400 pounds per acre. Capability unit IIIe–2, dryland, and IIIe–2, irrigated; Deep Hardland range site.

Brownfield Series

The Brownfield series consists of deep, nearly level and gently undulating fine sands that formed in eolian material.

In a representative profile (fig. 11), the surface layer is fine sand about 26 inches thick. It is brown in the upper part and light brown in the lower part. The next layer is red, firm sandy clay loam about 38 inches thick. The next lower layer is yellowish-red, friable sandy clay loam about 16 inches thick. Below this, to a depth of 90 inches, is reddish-yellow fine sandy loam.

Brownfield soils have a moderate available water capacity and are moderately permeable.

Most areas of Brownfield soils are in native range (fig. 12). A few small areas are cultivated and are irrigated.

Representative profile of Brownfield fine sand, 0.45 mile north of the southeast corner of section 16, block B, R. M. Thompson Survey (about 0.2 mile east of Lamb County line on Farm Road 1315, then 1.5 miles north):

A11—0 to 8 inches, brown (7.5YR 5/4) fine sand, dark brown (7.5YR 4/4) when moist; single grain (structureless); loose; neutral; gradual, wavy boundary.

A12—8 to 26 inches, light-brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) when moist; single grain (structureless); loose; neutral; clear, wavy boundary.

B21t—26 to 42 inches, red (2.5YR 5/5) sandy clay loam, dark reddish brown (2.5YR 3/5) when moist; moderate, coarse, prismatic parting to moderate, medium, subangular blocky structure; very hard, firm; many very fine and fine pores; common worm casts; distinct clay films on ped surfaces; neutral; gradual, wavy boundary.

B22t—42 to 64 inches, red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) when moist; moderate, coarse, prismatic parting to moderate, medium, subangular blocky structure; very hard, firm; patchy clay films on ped surfaces; common fine pores; neutral; diffuse, wavy boundary.

B3—64 to 80 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; weak, coarse, prismatic structure; friable; mildly alkaline; diffuse, wavy boundary.

C—80 to 90 inches, reddish-yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) when moist; massive (structureless); very friable; mildly alkaline.

The A horizon ranges from light brown or brown to reddish yellow in color and from 20 to 40 inches in thickness. The B2t horizon is red or reddish brown in color and sandy clay loam or clay loam in texture. The B3 horizon is yellowish red to reddish yellow in color and fine sandy loam to sandy clay loam in texture. The C horizon is sandy clay loam to loamy fine sand in texture. The C horizon begins at a depth of 65 to 90 inches.

Figure 11.—**Profile of Brownfield fine sand.**

Brownfield fine sand (Br).—This nearly level and gently undulating soil occupies upland plains. The dominant slope is about 0.8 percent. The areas are mostly narrow and irregular in shape.

Figure 12.—**Typical area of Brownfield fine sand. Deep Sand range site.**

Included with this soil in mapping are small areas of Springer, Amarillo, and Tivoli soils. These inclusions are mostly small spots that are less than 10 acres in size. Also included are spots of soils that have a surface layer less than 20 inches thick. A part of this mapping unit has been severely eroded by soil blowing. These areas were formerly in cultivation but have returned to range.

This soil is best suited to perennial grasses. Most areas are in native range, and a few irrigated areas are in bermudagrass. Most areas that were once cultivated have a billowy surface as a result of soil blowing. The hazard of soil blowing is severe.

If irrigated and carefully managed, this soil can be cultivated. Growing a closed-spaced crop continuously produces crop residue that protects the surface. Proper fertilization and limited tillage using stubble mulch are also needed. Areas of this soil that are undulating or hummocky need smoothing of the surface in places so that sprinkler irrigation systems can effectively be used to apply controlled amounts of irrigation water. Pipelines must be used if irrigation water is to be supplied from one location to another. Pasture requires fertilizer, frequent irrigation from a properly designed system, rotational grazing, and proper grazing management.

If well managed as rangeland, tall grasses can be grown on this soil. The dominant climax grasses are indiangrass, sand bluestem, switchgrass, little bluestem, sand lovegrass, and side-oats grama. Other important grasses are giant dropseed, sand dropseed, hairy grama, silver bluestem, hooded windmillgrass, and three-awn. Some of the grasses that invade are lovegrass, tumble windmillgrass, yucca, sand sagebrush, skunkbrush, ragweed, and annual grasses. The hazard of soil blowing is severe, and this soil should be kept under a permanent protective cover. Depending on variations in rainfall, the average annual production of air-dry herbage on range in excellent condition is about 1,500 to 3,200 pounds per acre. Capability unit VIe–1, dryland, and IVe–2, irrigated; Deep Sand range site.

Drake Series

The Drake series consists of deep, gently sloping to sloping clay loams or sandy clay loams that are high in content of lime. These soils occupy low, smooth dunes that partly encircle many of the playas. They formed in windblown deposits that settled on the east and south sides of playas. These deposits are 2 to 10 feet thick. Slopes are convex and range from 1 to 8 percent.

In a representative profile (fig. 13), the surface layer

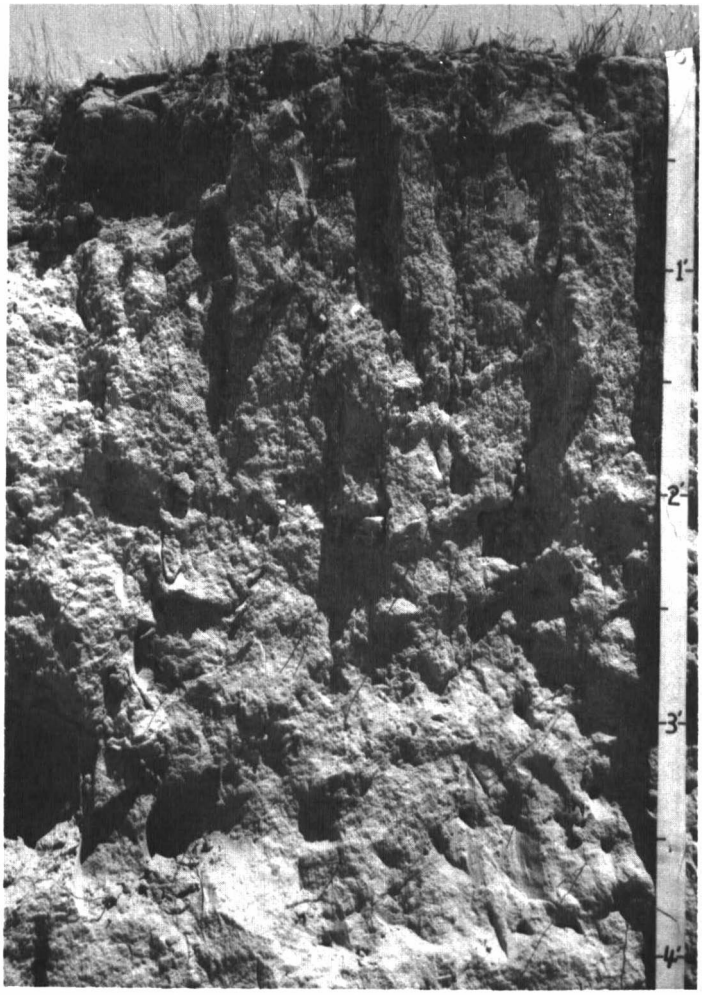

Figure 13.—**Profile of a Drake soil.**

is grayish-brown sandy clay loam about 10 inches thick. The next layer is light brownish-gray, very friable sandy clay loam about 14 inches thick. Below this, to a depth of 50 inches, is very pale brown sandy clay loam.

Drake soils are well drained and are moderately permeable. They have a high available water capacity. The high lime content causes some plant nutrients to be unavailable to plants, resulting in chlorosis or yellowing of leaves on some plants.

vated. A few areas are irrigated.

About one-half of the acreage of Drake soils is culti-

Representative profile of Drake sandy clay loam in an area of Drake soils, 3 to 8 percent slopes, 0.2 mile north

and 0.2 mile west of the southeast corner of section 48, block A–3 ELRR Railroad Survey (5.0 miles east of Cotton Center on Farm Road 1315, 2.8 miles south, and 0.2 mile west in field):

A1—0 to 10 inches, grayish-brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) when moist; weak, fine and medium, granular structure; hard, very friable; many pores and worm casts; calcareous; moderately alkaline; gradual, smooth boundary.

C1—10 to 24 inches, light brownish-gray (10YR 6/2) sandy clay loam, grayish brown (10YR 5/2) when moist; massive (structureless); hard, very friable; many fine pores, common worm casts; calcareous; moderately alkaline; gradual, wavy boundary.

C2—24 to 50 inches, very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) when moist; massive (structureless); very friable; calcareous; moderately alkaline.

The A1 horizon ranges from 6 to 10 inches in thickness, from sandy clay loam to clay loam in texture, and from light brownish gray to grayish brown in color. The C1 horizon ranges from sandy clay loam to clay loam in texture and from pale brown or brown to grayish brown or light brownish gray in color. The C2 horizon is white, light brownish gray, pale brown, or very pale brown. It ranges from sandy clay loam to clay loam in texture. The content of clay between depths of 10 and 40 inches is 18 to 33 percent.

Drake clay loam, 1 to 3 percent slopes (DrB).—This gently sloping soil occupies the east and south sides of playa lakes. The dominant slope is 2 to 3 percent. Most areas are narrow in shape and are less than 25 acres in size.

The surface layer is grayish-brown, very friable clay loam about 10 inches thick. The next layer is light brownish-gray, very friable clay loam about 14 inches thick. Below this, to a depth of 50 inches, is very pale-brown sandy clay loam.

Included with this soil in mapping are small areas of Estacado, Mansker, and Posey soils. Also included are a few areas of soils that have buried clayey layers at a depth of 2 to 4 feet.

Most of this soil is cultivated. A few areas are irrigated. Small grain and sorghums are the main crops. The hazard of soil blowing is severe.

Good management of cropland is needed to control soil blowing. Management consists of growing sorghum and small-grain crops that produce residue in the rotation and leaving the residue on the surface. Fertilization of crops and careful application of irrigation water in a properly designed system are also needed. In places diversion terraces, terraces, and grassed waterways are needed to control erosion and dispose of excess runoff water. Management of pasture should include the proper and timely use of irrigation water and fertilizer, including trace elements if needed.

The dominant climax grasses are blue grama, side-oats grama, and plains bristlegrass. Other important grasses are buffalograss, black grama, silver bluestem, and sand dropseed. Plants that invade are broomweed, sand muhly, and annual grasses. The hazard of soil blowing is severe, and a good cover of vegetation is needed. Depending on variations in rainfall, the average annual production of air-dry herbage on range in excellent condition is about 1,100 to 1,800 pounds per acre. Capability unit IVe–4, dryland, and IIIe–3, irrigated; High Lime range site.

Drake soils, 3 to 8 percent slopes (DsD).—These soils are on low dunes on the east and south sides of playas. The slope is convex and smooth and averages about 4 percent. Most areas occur as narrow bands about 10 to 50 acres in size. The surface layer is sandy clay loam and clay loam. One of the soils in this mapping unit has the profile described as representative for the series.

Included with these soils in mapping are areas of a soil similar to these Drake soils, except that the texture is fine sandy loam between depths of 10 and 40 inches. Also included are a few small areas of Mansker and Posey soils. These inclusions make up less than 15 percent of the acreage.

These soils are not suited to dryland farming, but some areas are in cultivation. A few areas are irrigated. Some areas that were once cultivated have returned to perennial grass. Small grain and sorghum are the main crops. The hazards of soil blowing and water erosion are severe. Some areas have shallow gullies where runoff water has concentrated.

Good management of cropland is needed to control soil blowing and water erosion. Management consists of growing sorghum and small-grain crops that produce residue in the rotation and leaving the residue on the surface. Fertilization of crops and careful application of irrigation water in a properly designed system are also needed. In places diversion terraces, terraces, and grassed waterways are needed.

Good management of pasture consists of proper and timely use of water and fertilizer. Trace elements are needed on some crops to overcome the yellowing of plants, or chlorosis, that commonly occurs on these soils.

The dominant climax grasses are blue grama, side-oats grama, and plains bristlegrass. Other important grasses are buffalograss, black grama, silver bluestem, and sand dropseed. Plants that invade are broomweed, sand muhly, and annual grasses. Because the hazard of soil blowing is severe, a good cover of vegetation is needed. Depending on variations in rainfall, the average annual production of air-dry herbage on range in excellent condition is about 1,100 to 1,800 pounds per acre. Capability unit VIe–3, dryland, and IIIe–7, irrigated; High Lime range site.

Estacado Series

The Estacado series consists of deep, nearly level to gently sloping loams that formed in calcareous, loamy, eolian material. These soils occur on upland plains and on slopes around playa lakes and along draws. The slope ranges from 0.5 to 3.0 percent.

In a representative profile (fig. 14), the surface layer is brown loam about 16 inches thick. The next layer, about 12 inches thick, is reddish-brown, friable clay loam that contains many concretions of lime. The next lower layer, about 32 inches thick, is light reddish-brown friable clay loam that is about 35 percent accumulations of lime. Below this, to a depth of more than 80 inches, is reddish-yellow clay loam that contains concretions and masses of lime.

Estacado soils are well drained and are moderately permeable. The available water capacity is high. The free lime in the surface layer occasionally causes a deficiency of plant nutrients for some crops.

Most areas of these soils are cultivated. Many areas are irrigated. Some areas are in pasture, and a few areas are in native grass.

Representative profile of Estacado loam, 0 to 1 percent slopes, 50 feet north and 100 feet east of the southwest

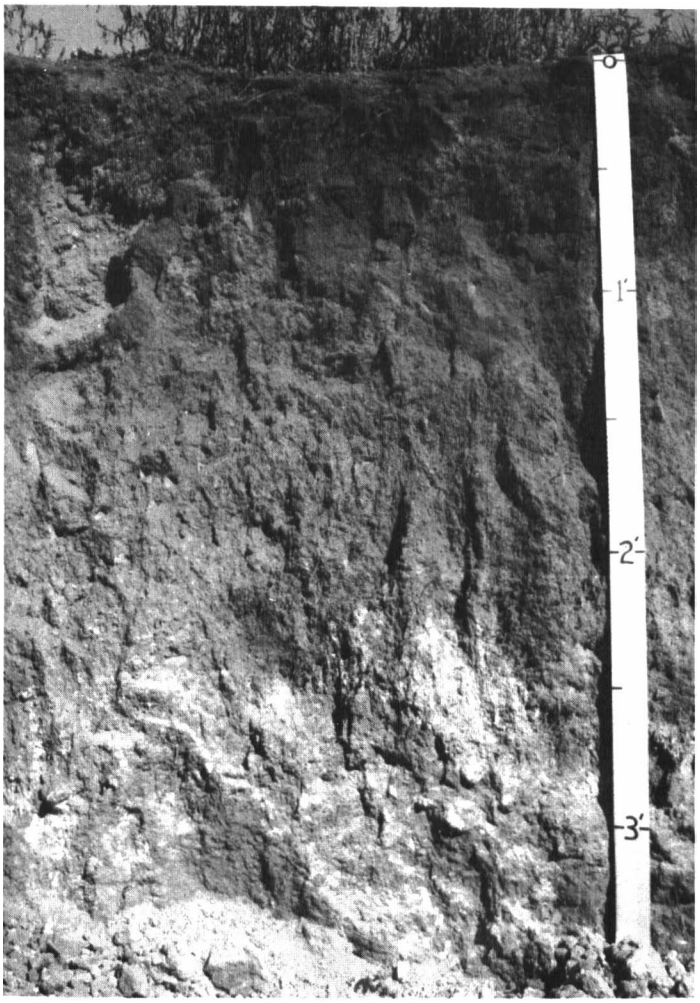

Figure 14.—**Profile of Estacado loam, 0 to 1 percent slopes. Calcic horizon begins at a depth of about 24 inches.**

corner of section 24, block JK–2, GC&SF Railroad Survey (from the intersection of U.S. Highway 70 in Plainview, 5.0 miles northwest on State Highway 194 and 0.7 mile south on county road) :

Ap—0 to 16 inches, brown (7.5YR 4/3) loam, dark brown (7.5YR 3/3) when moist; weak, medium, granular structure; slightly hard, friable; common fine pores; many worm casts; few, slightly cemented calcium carbonate concretions 2 to 5 millimeters in diameter; calcareous; moderately alkaline; abrupt, smooth boundary.

B21tca—16 to 28 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) when moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; hard, friable; many fine pores; common worm casts; few clay films; many, fine, soft calcium carbonate concretions 2 millimeters in diameter; calcareous; moderately alkaline; gradual, wavy boundary.

B22tca—28 to 60 inches, light reddish-brown (5YR 6/4) clay loam, reddish brown (5YR 5/4) when moist; weak, coarse, prismatic structure parting to weak, fine, subangular blocky; hard, friable; few fine roots; many fine pores; calcium carbonate accumulations make up about 35 percent of soil mass, which consists of slightly cemented masses up to 3 inches in diameter and concretions ranging from 1 to 1.5 centimeters in diameter and containing soft masses on ped surfaces; calcareous; moderately alkaline; gradual, irregular boundary.

B23tca—60 to 80 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) when moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; few fine roots; common fine pores; few clay films on peds; mass is made up of bridged sand grains; many, slightly cemented, calcium carbonate concretions 1 to 2 millimeters in diameter and a few masses up to 8 millimeters in diameter on ped surfaces; calcareous; moderately alkaline; gradual, smooth boundary.

B24tca—80 to 105 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) when moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; few large pores and root channels, some of which are filled with darker organic stains; patchy clay films and oriented clay around root channels; 10 percent of mass is bridged sand grains that contain finely disseminated calcium carbonate and scattered concretions ranging to soft masses up to 1 centimeter in diameter; calcareous; moderately alkaline.

The solum ranges from 60 inches to more than 100 inches in thickness. The A horizon is 8 to 18 inches thick. It ranges from brown or dark brown to grayish brown or dark grayish brown in color. The upper 20 inches of the Bt horizon has a clay content of 24 to 35 percent. The Bt horizon is reddish brown, light reddish brown, reddish yellow, brown, or grayish brown. Typically, visible carbonates range from 10 to 30 percent in the B21tca horizon, increase to 20 to 50 percent in the B22tca horizon, and then decrease with depth.

Estacado loam, 0 to 1 percent slopes (EsA).—This soil occupies areas around playa depressions and the upland plains. The dominant slope is about 0.7 percent. Most areas are less than 300 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of Zita and Mansker soils.

Most areas of this soil are in irrigated cropland. Wheat, grain sorghum, and cotton are the main crops. Some plants growing on this soil show chlorosis, or yellowing of leaves, because of a deficiency of some nutrients, such as iron. This soil has moderate permeability. The available water capacity is high. The hazard of water erosion is slight, and the hazard of soil blowing is moderate.

Careful management of crop residue and timely and limited tillage help to control soil blowing. In places diversion terraces and waterways are needed to dispose of excess rainfall. If this soil is irrigated, a planned irrigation system is needed to conserve water and control erosion. Fertilizer is also needed, and some crops on this soil respond to applications of trace elements.

The dominant climax grasses are blue grama, side-oats grama, buffalograss, and black grama. If the site is overgrazed, buffalograss becomes more abundant. Most areas of this soil are kept in good condition. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is about

1,400 to 2,200 pounds per acre. Capability unit IIIe–4, dryland, and IIe–1, irrigated; Hardland Slopes range site.

Estacado loam, 1 to 3 percent slopes (EsB).—This soil occupies positions around playa lakes and along draws. The dominant slope is about 1.5 percent. Most areas are narrow and are elongated. They range from 10 to 250 acres in size.

The surface layer is brown loam about 12 inches thick. The next layer is brown, friable clay loam about 20 inches thick. Below this layer is about 24 inches of light reddish-brown, friable clay loam that is about 35 percent accumulations of lime. It is underlain by reddish-yellow clay loam.

Included with this soil in mapping are areas of Mansker, Midessa, Olton, and Zita soils that are less than 5 acres in size. Also included are a few areas of eroded soils. These areas have a few shallow gullies and the surface is thinner than that of this Estacado soil.

Most areas are cultivated, and many areas are irrigated. Cotton, small grain, and grain sorghum are the main crops. The hazards of water erosion and soil blowing are moderate.

Management to control soil blowing and water erosion includes use of a suitable crop rotation, such as growing wheat and sorghum, residue management, timely tillage, and use of terracing and contour farming. In places diversion terraces, terraces, and waterways are used to dispose of excess rainfall. This soil responds to fertilization if irrigated. Some crops respond to applications of trace elements, such as iron. If this soil is irrigated, a properly designed irrigation system is also needed.

The dominant climax grasses are side-oats grama, blue grama, buffalograss, and black grama. If this site is overgrazed, buffalograss becomes more abundant. Most areas of this site are kept in good condition. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is 1,400 to 2,200 pounds per acre. Capability unit IIIe–2, dryland, and IIIe–2, irrigated; Hardland Slopes range site.

Lofton Series

The Lofton series consists of deep, nearly level soils on low benches surrounding playa lakes and in small, shallow depressions on the upland plain. These soils formed in clayey local alluvium.

In a representative profile (fig. 15), the surface layer is dark grayish-brown clay loam about 9 inches thick. The next layer is dark grayish-brown, very firm clay about 21 inches thick. The next lower layer, about 20 inches thick, is light brownish-gray clay that contains a few accumulations of lime. Below this is white clay loam that contains about 25 percent soft lumps of lime in the upper part and a few in the lower part.

Lofton soils have a high available water capacity. Permeability is very slow.

Most areas of Lofton soils are cultivated, and most of these areas are irrigated.

Representative profile of Lofton clay loam, 0.5 mile east of the southwest corner of section 95, block D–2, TT Railroad Survey and 100 feet north into field (3.0 miles east of the intersection of Farm Roads 400 and 788, on Farm Road 788, then 2.0 miles south and 0.5 mile east on county road):

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; very hard, friable; mildly alkaline; abrupt, smooth boundary.

B21t—9 to 20 inches, dark grayish-brown (10YR 4/2) clay, very dark brown (10YR 2/2) when moist; moderate, fine, angular blocky structure; extremely hard, very firm; vertical cracks and lenses of Ap material throughout; few pores; continous clay film on peds; calcareous; moderately alkaline; gradual, smooth boundary.

B22t—20 to 30 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) when moist; moderate, fine, angular blocky structure; extremely hard, very firm; thin continuous clay films on peds; few iron concretions; evidence of cracks to a depth of 24 inches that have lenses of Ap material; calcareous; moderately alkaline; gradual, wavy boundary.

B23t—30 to 50 inches, light brownish-gray (10YR 6/2) clay; grayish brown (10YR 5/2) when moist; moderate, fine and medium, blocky structure; very hard, firm; few soft lumps and common films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

B24tca—50 to 60 inches, white (10YR 8/2) clay loam; light gray (10YR 7/2) when moist; weak, medium, blocky structure; hard, friable; soft lumps of calcium carbonate make up about 25 percent of soil mass by volume; calcareous; moderately alkaline; diffuse, wavy boundary.

C—60 to 72 inches, white (10YR 8/1) clay loam, light gray (10YR 7/1) when moist; massive (structureless); friable; many, faint, reddish-yellow mottles; few segregated calcium carbonate accumulations; calcareous; moderately alkaline.

The A horizon is 6 to 14 inches thick. It is dark brown or dark grayish brown in color. The B2t horizon has a clay content of about 40 to 50 percent. It is dark gray, light brownish gray, white, or dark grayish brown. The C horizon is pale brown, white, or light gray.

Lofton clay loam (Lo).—This nearly level soil occupies low benches around playa lakes. The dominant slope is about 0.3 percent. Most areas encircle the playa lakes and are round in shape and have smooth boundaries. These areas are less than 100 acres in size.

Included with this soil in mapping are a few spots of Pullman soils. Also included are a few small areas of soils that have free lime in the surface layer. These inclusions are less than 10 acres in size.

Most areas of this soil are in irrigated cropland. Cotton, wheat, grain sorghum, and soybeans are the main crops. Most areas receive some extra runoff water from surrounding soils that occupy higher positions. The hazard of soil blowing is slight.

Good management consists of leaving large amounts of residue on the surface to protect this soil from soil blowing. Management of irrigation water in a properly designed irrigation system is also needed. If this soil is irrigated, most crops respond to fertilizer. In places terraces, diversion terraces, or waterways are needed.

The dominant climax grasses are blue grama, buffalograss, and western wheatgrass. If the site is overgrazed, buffalograss becomes more abundant. Most areas of this site are kept in good condition. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is 1,000 to 2,200 pounds per acre. Capability unit IIIe–5, dryland, and IIs–1, irrigated; Deep Hardland range site.

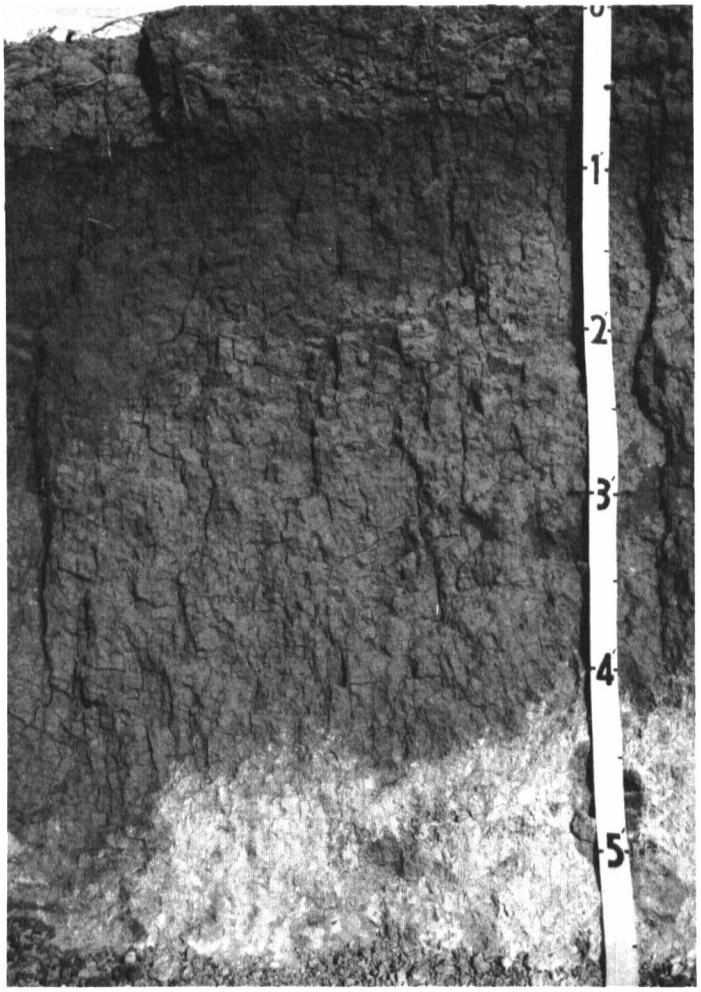

Figure 15.—**Profile of Lofton clay loam. Calcic horizon begins at a depth of 48 to 54 inches. Cracks extend to a depth of about 48 inches.**

Mansker Series

The Mansker series consists of deep, nearly level to gently sloping loams that formed in loamy, calcareous, eolian material.

In a representative profile (fig. 16), the surface layer is grayish-brown loam about 6 inches thick. The next layer is dark grayish-brown, friable clay loam about 6 inches thick. The next lower layer, about 16 inches thick, is pink, friable clay loam that is about 50 percent lime accumulations. Below this, to a depth of about 30 inches, is reddish-yellow clay loam that is about 10 percent lime accumulations.

Mansker soils have a high available water capacity. Permeability is moderate.

Most areas of Mansker soils are cultivated. Many areas are irrigated. A few areas of the steeper soils have been reseeded to native grass.

Representative profile of Mansker loam, 0 to 3 percent slopes, 1.1 miles northwest of Edmonson on State Highway 194, 3.0 miles west and 0.3 mile south on county road, then 100 feet east into field:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; slightly hard, friable, sticky, slightly plastic; common roots; many fine pores; many worm casts; common strongly cemented and few weakly cemented concretions of calcium carbonate up to about 1 centimeter in diameter; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—6 to 12 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, prismatic structure parting to moderate, medium, granular; slightly hard, friable, sticky, slightly plastic; many fine pores; many worm casts; common roots; common strongly cemented and few weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; diffuse, wavy boundary.

B21tca—12 to 28 inches, pink (7.5YR 7/4) clay loam, light brown (7.5YR 6/4) when moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; few roots; few worm casts; about 50 percent by volume of calcium carbonate in the form of weakly cemented concretions, powdery masses, and a few strongly cemented concretions up to about 1 centimeter in diameter; calcareous; moderately alkaline; diffuse, wavy boundary.

B22tca—28 to 60 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) when moist; moderate, coarse, prismatic structure parting to subangular blocky; slightly hard, friable, slightly sticky, slightly plastic; few fine roots in upper part; about 10 percent, visible, weakly cemented concretion up to about 1 centimeter in diameter and powdery masses of calcium carbonate; patchy clay films on ped surfaces; calcareous; moderately alkaline.

The A horizon is 10 to 15 inches thick. It is brown, reddish brown, dark grayish brown, or grayish brown. The B21tca horizon ranges from sandy clay loam to clay loam. The calcium carbonate content of this horizon ranges from 20 to 60 percent. It is light reddish brown, pink, brown, or light brown. The zone of maximum calcium carbonate accumulation begins at a depth of 10 to 18 inches. The B22tca horizon is red or reddish yellow. It ranges from clay loam to sandy clay loam in texture.

Mansker loam, 0 to 3 percent slopes (MkB).—This soil occupies narrow areas around playa lakes and along the draws. The dominant slope is about 2 percent. This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of Estacado, Posey, and Potter soils. These inclusions are less than 10 acres in size. Also included are a few areas of eroded soils. A few shallow gullies are in these areas, and the surface layer is thinner than is normal for this Mansker soil.

Most areas of this soil are cultivated, and most of these are irrigated. Cotton, small grain, and grain sorghum are the main crops. Native species, such as side-oats grama and blue grama, also grow well on these soils. The hazard of soil blowing is severe, and the hazard of water erosion is moderate.

Management to control soil blowing and erosion includes using crops such as small grain and sorghum and the residue from these crops to provide a cover. If this soil is irrigated, fertilizer is also needed. In places applications of trace elements are needed on some crops to overcome an iron deficiency. Management of irrigation water in a properly designed irrigation system is needed. In places other erosion control measures, such as terraces, diversion terraces, and grassed waterways, are needed.

Figure 16.—**Profile of Mansker loam, 0 to 3 percent slopes. Calcic horizon begins at a depth of about 12 inches.**

The dominant climax grasses are side-oats grama, blue grama, and buffalograss. Other important grasses are vine-mesquite, Arizona cottontop, hairy grama, and black grama. Plants that invade are sand dropseed, sand muhly, catclaw, three-awn, broom snakeweed, and annual grasses. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is about 1,300 to 1,800 pounds per acre. Capability unit IVe–2, dryland, and IIIe–6, irrigated; Hardland Slopes range site.

Mansker loam, 3 to 5 percent slopes (MkC).—This soil occupies convex areas around the deep playa lakes and along the draws. Slopes average about 4 percent. Most areas are narrow and long in shape. The areas are 10 to 200 acres in size.

The surface layer is brown loam about 10 inches thick. The next layer is light reddish-brown, friable clay loam about 15 inches thick. Below this is reddish-yellow clay loam.

Included with this soil in mapping are areas of Posey, Berda, and Potter soils. In about 15 percent of the areas, the plow layer has dipped into the soft caliche layer. Also included are a few areas of this Mansker soil that are eroded and that have a few, shallow, crossable gullies. A few small areas of soils that have a slope of 5 or 6 percent are also included.

Most areas of this soil are cultivated. A few cultivated areas have been reseeded to native grass. Small grain and grain sorghum are the main crops. A few areas are in bermudagrass and alfalfa. This soil requires good management. The hazard of soil blowing is severe.

Management consists of fertilizing and of growing residue-producing and protective crops continuously. Limited tilling and stubble mulching help to reduce erosion. A sprinkler system of irrigation is best suited to this soil. In places terracing, contour farming, and using grassed waterways and diversions are needed. Pastures need grazing management, fertilization, frequent irrigation, and rotational grazing for best results.

The dominant climax grasses are side-oats grama, blue grama, and buffalograss. Other important grasses are vine-mesquite, hairy grama, Arizona cottontop, and black grama. Plants that invade are sand dropseed, sand muhly, catclaw, three-awn, broom snakeweed, and annual grasses. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is about 1,300 to 1,800 pounds per acre. Capability unit IVe–6, dryland, and IVe–3, irrigated; Hardland Slopes range site.

Midessa Series

The Midessa series consists of deep, nearly level to gently sloping fine sandy loams that formed in calcareous eolian material.

In a representative profile, the surface layer is grayish-brown fine sandy loam about 12 inches thick. The next layer is pale-brown, friable sandy clay loam about 18 inches thick. The next lower layer, about 14 inches thick, is pink, friable sandy clay loam that is about 40 percent soft, powdery masses of lime. Below this is pink sandy clay loam that contains about 5 percent lime masses.

Midessa soils have a high available water capacity and moderate permeability.

Most areas of these soils are cultivated.

Representative profile of Midessa fine sandy loam, 1 to 3 percent slopes, 0.1 mile north of the southeast corner of section 86, EL&RR Railroad Survey (from the intersection of Farm Road 54 and U.S. Highway 87, 3.0 miles west on Farm Road 54, then 1.1 miles north on county road):

Ap—0 to 12 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, granular structure; soft, very friable; calcareous; moderately alkaline; abrupt, smooth boundary.

B2—12 to 30 inches, pale-brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) when moist; weak, coarse, prismatic parting to weak, medium, subangular blocky structure; hard, friable; common worm casts, many fine pores; few films of calcium carbonate; calcareous; moderately alkaline; clear, wavy boundary.

C1ca—30 to 44 inches, pink (7.5YR 7/4) sandy clay loam, light brown (7.5YR 6/4) when moist; massive (structureless); hard, friable; about 40 percent soft powdery masses of calcium carbonate; calcareous; moderately alkaline; diffuse, wavy boundary.

C2—44 to 76 inches, pink (7.5YR 7/4) sandy clay loam, light brown (7.5YR 6/4) when moist; massive (structureless); about 5 percent films, threads, and fine masses of calcium carbonate; calcareous; moderately alkaline.

The A horizon ranges from 10 to 20 inches in thickness and from reddish brown to grayish brown in color. The B horizon ranges from reddish brown or brown to pale brown in color and from clay loam to sandy clay loam in texture. The calcium carbonate content of the C1ca horizon ranges from 20 to 50 percent. The C1ca horizon ranges from pink or reddish yellow to pale brown in color and from sandy clay loam to clay loam in texture.

Midessa fine sandy loam, 0 to 1 percent slopes (MsA).—This soil occurs in playa lake basins. The areas are less than 40 acres in size. The dominant slope is about 0.5 percent.

The surface layer is brown fine sandy loam about 16 inches thick. The next layer is pale-brown, friable sandy clay loam about 24 inches thick. The next lower layer is pink sandy clay loam that is about 14 inches thick and contains about 30 percent masses of lime. Below this is pink sandy clay loam that contains about 10 percent lime masses.

Included with this soil in mapping are areas of Amarillo, Estacado, and Zita soils.

Most areas of this soil are cultivated. Cotton and grain sorghum are the main crops. Some crops show deficiency of iron and yellowing of leaves. The hazard of soil blowing is severe.

Management to control soil blowing consists of management of crop residue, use of a suitable crop rotation, fertilization, and timely and limited tillage. In places grassed waterways and diversion terraces are needed to control water. If this soil is irrigated, management of irrigation water and a properly planned irrigation system are needed.

The dominant climax grasses are side-oats grama, blue grama, cane bluestem, black grama, and sand dropseed. Plants that invade are mesquite, yucca, catclaw, and annual grasses. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is 1,300 to 2,300 pounds per acre. Capability unit IIIe–3, dryland, and IIe–2, irrigated; Sandy Loam range site.

Midessa fine sandy loam, 1 to 3 percent slopes (MsB).—This soil mainly occupies the south and east sides of deep playa lakes. The dominant slope is about 1.5 percent. Most areas are 10 to 50 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are Estacado soils in small areas less than 10 acres in size. Also included are small areas of soils that do not have a layer of soft, powdery lime within a depth of 40 inches, and a few areas of soils that are free of lime in the surface layer. Also included are a few spots of soils that have buried clayey layers at a depth of 3 to 5 feet.

Most areas of this soil are cultivated. Some plant nutrients, such as iron, are deficient in places. Crops, such as sorghum, commonly show chlorosis if grown on this soil. The hazard of soil blowing is severe, and the hazard of water erosion is slight.

Management of these soils should include leaving crop residue on the surface as much as possible during the critical period of soil blowing. In places terraces and waterways are needed. Most crops respond to fertilizer. If this soil is irrigated, a properly planned sprinkler irrigation system and water management are needed.

The dominant climax grasses are side-oats grama, blue grama, cane bluestem, black grama, and sand dropseed. Plants that invade are mesquite, yucca, catclaw, and annual grasses. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is 1,300 to 2,300 pounds per acre. Capability unit IIIe–3, dryland, and IIIe–3, irrigated; Sandy Loam range site.

Olton Series

The Olton series consists of deep, nearly level to gently sloping loams that are on upland plains, around playas, and along draws. The slope ranges from 0 to 3 percent. These soils formed in loamy, calcareous, eolian deposits.

In a representative profile, the surface layer is reddish-brown loam about 14 inches thick. The next layer is reddish-brown, firm clay loam about 16 inches thick. Below this layer is 12 inches of yellowish-red, friable clay loam that contains a few masses of lime. The next lower layer, about 18 inches thick, is pink clay loam that is about 35 percent soft lumps and concretions of lime. Below this is reddish-yellow clay loam that is about 10 percent soft lumps of lime.

Olton soils have a high available water capacity. Permeability is moderately slow.

Most areas are cultivated, and many areas are irrigated. A few small areas are in native range.

Representative profile of Olton loam, 0 to 1 percent slopes, 0.35 mile east and 100 feet south of the northwest corner of section 83, block A–4, EL&RR Railroad Survey (from the intersection of U.S. Highway 87 and Farm Road 54, 2.0 miles north on U.S. Highway 87 and 1.65 miles west on county road):

Ap—0 to 14 inches, reddish-brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) when moist; weak, fine and medium, granular structure; hard, friable; mildly alkaline; abrupt, smooth boundary.

B21t—14 to 22 inches, reddish-brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) when moist; moderate, fine and medium, blocky structure; very hard, firm; few pores; thin clay films on peds; mildly alkaline; gradual, smooth boundary.

B22t—22 to 30 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) when moist; moderate, medium, blocky structure; very hard, firm; few very fine pores; thin clay films on peds; few soft masses, films, and threads of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

B23t—30 to 42 inches, yellowish-red (5YR 5/6) clay loam, yellowish red (5YR 4/6) when moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; very hard, friable; few soft lumps and many films and threads of calcium carbonate; calcareous; moderately alkaline; clear, wavy boundary.

B24tca—42 to 60 inches, pink (5YR 7/4) clay loam, light reddish brown (5YR 6/5) when moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; very hard, firm; patchy clay films; many soft lumps and concretions of calcium carbonate making up about 35 percent of soil mass by volume; calcareous; moderately alkaline; diffuse, wavy boundary.

B25t—60 to 72 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 4/6) when moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; very hard, firm; distinct clay films on peds; soft lumps of calcium carbonate make up about 10 percent of the soil mass by volume; calcareous; moderately alkaline.

The A horizon ranges from 6 to 14 inches in thickness and from brown to reddish brown in color. The B2t horizon above the zone of maximum calcium carbonate accumulation ranges from 35 to 42 percent clay. It is brown, reddish brown, yellowish red, or red. The Btca horizon begins at a depth of 30 to 60 inches. It ranges from light red to pink or reddish yellow in color. The calcium carbonate content of this horizon ranges from 15 to 60 percent. The B2t horizon below the zone of maximum calcium carbonate accumulation ranges from red to reddish yellow in color. The calcium carbonate content ranges from 5 to 15 percent.

Olton loam, 0 to 1 percent slopes (OtA).—This soil occupies upland plains. The dominant slope is about 0.5 percent. Many areas are large, ranging up to several thousand acres in size, and are interrupted only by scattered playa lakes. This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of Acuff, Estacado, and Pullman soils. Also included are a few areas of soils that have a fine sandy loam surface layer.

Most areas of this soil are in irrigated cropland. Cotton, wheat, and small grain are the main crops, but other suitable crops can be grown. The hazard of soil blowing is slight.

This soil responds to good management. Effective practices to control soil blowing include leaving crop residue on the surface and limited tilling. If this soil is irrigated, a properly planned irrigation system, fertilization, and proper application of water are needed. In places diversion terraces, terraces, or waterways are needed to control water from steeper soils or excess runoff.

The dominant climax grasses are blue grama, side-oats grama, and vine-mesquite. If the site is overgrazed, buffalograss becomes more abundant. Most areas of this soil are kept in good condition. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is 1,300 to 2,100 pounds per acre. Capability unit IIIe–4, dryland, and IIe–1, irrigated; Deep Hardland range site.

Olton loam, 1 to 3 percent slopes (OtB).—This soil occurs around playa lakes and along draws. The dominant slope is about 1.5 percent. Most areas range from 20 to 300 acres in size.

The surface layer is brown loam about 12 inches thick. The next layer is reddish-brown, firm clay loam about 20 inches thick. The next lower layer is about 18 inches of pink clay loam that is about 30 percent soft lumps and concretions of lime. Below this is reddish-yellow clay loam that is about 10 percent soft lumps and masses of lime.

Included with this soil in mapping are areas of Acuff, Amarillo, Pullman, and Estacado soils. These areas are less than 10 acres in size. Also included are a few small areas of eroded soils that have a few shallow gullies and a surface layer that is thinner than is normal for this Olton soil.

Most areas are cultivated, and many areas are irrigated. A few areas are in native range, and a few areas are in irrigated pasture. The hazard of soil blowing is slight, and the hazard of water erosion is moderate.

Good management consists of proper use of crop residue on the surface and limited tillage. Terracing and contour farming help to reduce the hazard of water erosion. In places diversions and grassed waterways are needed to control excess water. If this soil is irrigated, a well-designed irrigation system and water management are needed. Crops respond to fertilizer if this soil is irrigated.

The dominant climax grasses are blue grama, side-oats grama, and vine-mesquite. If the site is overgrazed, buffalograss becomes more abundant. Most areas of this site are kept in good condition. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is 1,300 to 2,100 pounds per acre. Capability unit IIIe–2, dryland, and IIIe–2, irrigated; Deep Hardland range site.

Posey Series

The Posey series consists of deep, nearly level to gently sloping fine sandy loams that formed in calcareous, loamy material along draws.

In a representative profile (fig. 17), the surface layer is brown fine sandy loam about 10 inches thick. The next

Figure 17.—**Profile of Posey fine sandy loam, 0 to 3 percent slopes. Calcic horizon begins at a depth of about 18 inches.**

layer is light reddish-brown, friable sandy clay loam about 8 inches thick. The next lower layer is 22 inches of pink, friable sandy clay loam that is about 40 percent soft masses and concretions of lime. Below this is reddish-yellow sandy clay loam that is about 10 percent soft masses of lime.

Posey soils are moderately permeable. They have a high available water capacity.

Most areas of these soils are cultivated. Some areas have been returned to grass or are idle. A few areas are in native vegetation.

Representative profile of Posey fine sandy loam, 0 to 3 percent slopes, 0.25 mile east of the northwest corner of section 27, Sabine County school land, and 300 feet south into field. (from Farm Road 54 at the Lamb County line, 0.8 mile north and 1.25 mile east on county road):

Ap—0 to 10 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) when moist; weak, fine and medium, granular structure; soft, very friable; few hard calcium carbonate concretions on surface; calcareous; moderately alkaline; abrupt, smooth boundary.

B21t—10 to 18 inches, light reddish-brown (5YR 6/4) sandy clay loam; reddish brown (5YR 5/4) when moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; hard, friable; few patchy clay films; many pores and worm casts; few films and soft masses of calcium carbonate; calcareous; moderately alkaline; clear, wavy boundary.

B22tca—18 to 40 inches, pink (5YR 7/4) sandy clay loam; light reddish brown (5YR 6/5) when moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; patchy clay films on ped surfaces; about 40 percent soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; diffuse, wavy boundary.

B23t—40 to 72 inches, reddish-yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) when moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; clay films on peds; many fine pores; about 10 percent calcium carbonate in soft masses, films, and threads; calcareous; moderately alkaline.

The A horizon ranges from 5 to 15 inches in thickness and from reddish brown to brown in color. The B2t horizon ranges from sandy clay loam to clay loam. The B21t horizon ranges from light reddish brown or reddish brown to brown in color. The B2tca horizon ranges from reddish brown to light reddish brown or pink in color. The calcium carbonate content of the B2tca horizon ranges from 25 to 60 percent and is in the form of soft masses and hard concretions. The B23t horizon ranges from red to reddish yellow in color.

Posey fine sandy loam, 0 to 3 percent slopes (PoB).—This soil occupies areas that are irregular in shape and 10 to 50 acres in size. The dominant slope is 1.5 to 2.0 percent. This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of Mansker, Midessa, and Potter soils.

Most areas of this soil are cultivated. A few areas are irrigated. Small grain, cotton, and grain sorghum are the main crops. The hazard of soil blowing is severe. The hazard of water erosion is moderate.

Effective practices to protect these soils are growing residue-producing crops, managing residue, limited tilling and contour farming and terracing. Stubble mulching is the best form of residue management. In places diversion terraces are needed to control outside water, and waterways are needed to carry off excess water. If this soil is irrigated, a well-planned irrigation system is needed. Fertilization and water management are also needed. Some crops respond to applications of trace elements, such as iron.

The dominant climax grasses are side-oats grama, blue grama, vine-mesquite, Arizona cottontop, and plains bristlegrass. Other important grasses are buffalograss, hairy grama, and black grama. Plants that invade include three-awn, sand dropseed, sand muhly, catclaw, broom snakeweed, and annual grasses. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is about 1,000 to 2,200 pounds per acre. Capability unit IVe–2, dryland, and IIIe–6, irrigated; Mixedland Slopes range site.

Posey fine sandy loam, 3 to 5 percent slopes (PoC).—This soil has convex slopes that average about 4 percent. Areas of this soil are long and narrow in shape and range from 10 to 40 acres in size.

The surface layer is brown fine sandy loam about 6 inches thick. The next layer is reddish-brown, friable sandy clay loam about 10 inches thick. The next lower layer, about 20 inches thick, is light reddish-brown sandy clay loam that is about 40 percent lime masses. Below this is reddish-yellow sandy clay loam that is about 15 percent lime masses.

Included with this soil in mapping are areas of Berda, Mansker, and Midessa soils. These inclusions are less than 10 acres in size. Also included are a few small areas of this soil that are eroded, have a few gullies, and have a surface layer that is thinner than is normal for this soil. A few small areas of soils that have a slope of 5 to 7 percent are also included.

Most areas have been cultivated, but many areas are now idle or have been returned to native vegetation. A few areas are irrigated. Small grain and sorghum are the main crops. This soil is not well suited to dryland farming. The hazards of water erosion and soil blowing are severe.

If this soil is irrigated, a close-spaced crop that produces large amounts of residue should be grown continuously and fertilizer should be used. The crop residue needs to be managed on the surface as much as possible. Terracing and contour farming are needed to reduce the hazard of water erosion. In places diversion terraces and waterways are needed to control excess water.

The dominant climax grasses are side-oats grama, blue grama, vine-mesquite, Arizona cottontop, and plains bristlegrass. Other important grasses are buffalograss, hairy grama, and black grama. Plants that invade include three-awn, sand dropseed, sand muhly, catclaw, broom snakeweed, and annual grasses. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is about 1,000 to 2,200 pounds per acre. Capability unit IVe–6, dryland, and IVe–3, irrigated; Mixedland Slopes range site.

Potter Series

The Potter series consists of gently sloping to sloping soils that are very shallow to shallow over caliche.

In a representative profile (fig. 18), the surface layer is brown gravelly loam about 8 inches thick. Below this

layer is pink loam that grades to sandy clay loam and contains much lime material or caliche in the form of soft masses and fragments up to 8 inches in diameter.

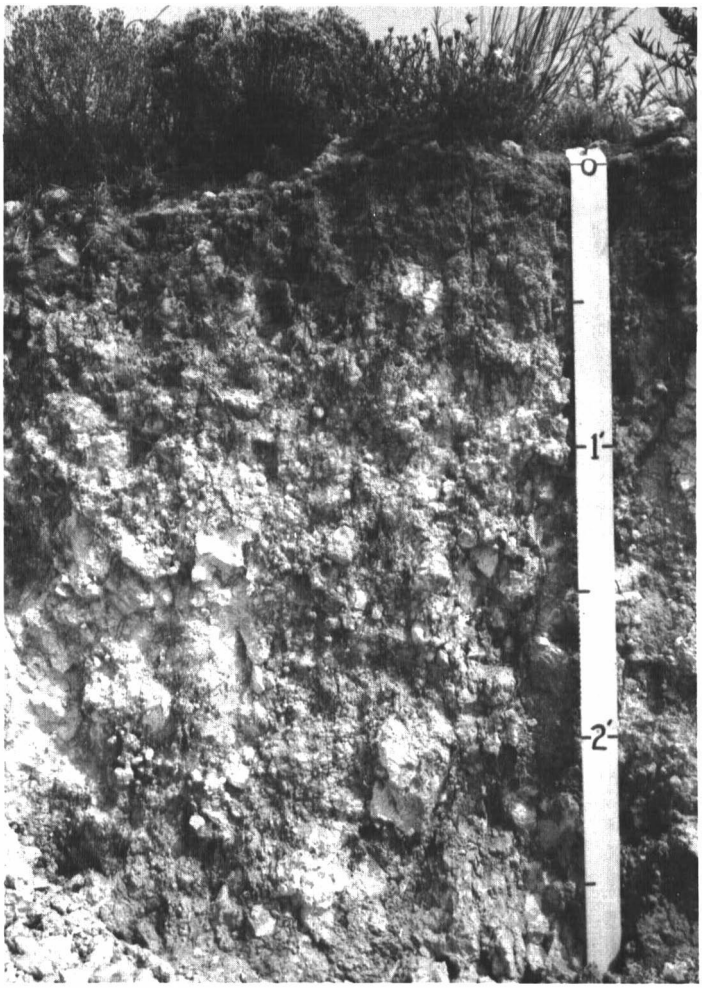

Figure 18.—**Profile of Potter gravelly loam. Caliche begins at a depth of about 6 inches.**

Potter soils have a low available water capacity. They are well drained and are moderately permeable.

These soils are better suited to native range than to most other uses.

Representative profile of Potter gravelly loam, 0.1 mile north of the southwest corner of section 12, block S–1, EL&RR Railroad Survey, and 100 feet east into pasture (6.0 miles north of U.S. Highway 70 on Farm Road 2284):

A1—0 to 8 inches, brown (7.5YR 5/2) gravelly loam, dark brown (7.5YR 4/2) when moist; weak, fine and medium, granular structure; hard, friable; many concretions of calcium carbonate ranging from fine to coarse on the surface and in the soil mass; calcareous; moderately alkaline; abrupt, irregular boundary.

C1ca—8 to 28 inches, pink (7.5YR 8/3) loam, pink (7.5YR 7/3) when moist; massive (structureless); about 70 to 80 percent of mass is calcium carbonate, some in soft masses, but most in hard fragments up to 6 to 8 inches in diameter; can be dug with a spade; calcareous; moderately alkaline; diffuse, irregular boundary.

C2—28 to 60 inches, pink (5YR 7/4) sandy clay loam; few caliche fragments and concretions; very friable; calcareous; moderately alkaline.

The A horizon ranges from 4 to 12 inches in thickness and from brown to grayish brown in color. The C1ca horizon ranges from pink to reddish yellow in color. It is loam, sandy clay loam, or clay loam in texture. The content of calcium carbonate ranges from 50 to 80 percent, and the calcium carbonate consists of soft masses to semihard and hard concretions. The C2 horizon ranges from clay loam to sandy clay loam in texture. The content of calcium carbonate ranges from 5 to 20 percent, and the calcium carbonate consists of soft masses to hard concretions.

Potter gravelly loam (Pt).—This soil occupies areas on sides of drainageways. The slope ranges from 4 to 7 percent. Most areas are narrow and are less than 50 acres in size. Areas of this soil are intermingled with areas of Mansker and Posey soils.

Included with this soil in mapping are areas of Mansker, Posey, and Estacado soils.

This soil generally is not suitable for cultivation. A few spots are in cultivation where small areas of this soil are in areas of soils that are suitable for cultivation.

The dominant climax grasses are side-oats grama, blue grama, and little bluestem. Other important grasses are buffalograss, black grama, hairy grama, sand dropseed, and three-awn. Plants that invade include hairy tridens, sand muhly, broom snakeweed, and annual grasses. Most areas have only a sparse cover. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is about 400 to 850 pounds per acre. Capability unit VIIs–1, dryland; Very Shallow range site.

Pullman Series

The Pullman series consists of deep, nearly level to gently sloping soils that formed in the thick eolian mantle that covers the High Plains. These soils are mainly on upland plains and occur as broad, continuous areas that are several thousand acres in size. A few areas are on gentle slopes around playa lakes. The slope ranges from 0.2 to 2.5 percent.

In a representative profile (fig. 19), the surface layer is brown clay loam about 10 inches thick. The next layer is brown, very firm clay about 28 inches thick. Below this layer is 8 inches of reddish-brown, firm clay. The next layer is 14 inches of pink clay loam that is about 35 percent soft masses of lime. Below this is reddish-yellow clay loam that is about 5 percent soft masses of lime.

Pullman soils have a high available water capacity. Permeability is very slow.

These soils are well suited to most crops adapted to the area. Most areas of Pullman soils are cultivated. Many areas are irrigated. A few areas are in native range.

Representative profile of Pullman clay loan, 0 to 1 percent slopes, 0.2 mile west of the southeast corner of section 42, block A–1, EL&RR Railroad Survey and 100 feet north of county road in field (4.8 miles south of the intersection of U.S. Highway 70 on U.S. Highway 87, then 0.3 mile east on county road):

Ap—0 to 10 inches, brown (7.5YR 5/2) clay loam, dark brown (7.5YR 3/2) when moist; weak, fine and medium, granular structure; very hard, friable; mildly alkaline; abrupt, smooth boundary.

B21t—10 to 26 inches, brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) when moist; strong, fine, angular blocky structure; extremely hard, very firm; few wedge-shaped peds; few short slickensides; few pores; thin continuous clay films; vertical lenses of Ap material to depths of 15 to 20 inches; mildly alkaline; gradual, wavy boundary.

B22t—26 to 38 inches, brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) when moist; moderate, fine, blocky structure; extremely hard, very firm; few wedge-shaped peds; few short slickensides; few pores; thin continuous clay films; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

B23t—38 to 46 inches, reddish-brown (5YR 5/4) clay, reddish brown (5YR 4/4) when moist; moderate, fine and medium, blocky structure; very hard, firm; thin clay films on ped surfaces; few pores; few soft masses of calcium carbonate making up about 1 percent of soil mass by volume; calcareous; moderately alkaline; clear, wavy boundary.

B24tca—46 to 60 inches, pink (5YR 8/4) clay loam, pink (5YR 7/4) when moist; moderate, medium, subangular blocky structure; very hard, friable; patchy clay films on peds; many soft masses and threads of calcium carbonate making up about 35 percent of the soil mass by volume; calcareous; moderately alkaline; diffuse, wavy boundary.

B25t—60 to 84 inches, reddish-yellow (5YR 7/6) clay loam, light reddish brown (5YR 6/4) when moist; moderate, medium, subangular blocky structure; very hard, very friable; distinct clay films on peds; about 5 percent calcium carbonate in soft powdery form; calcareous; moderately alkaline.

The A horizon ranges from 5 to 12 inches in thickness and from brown to dark brown in color. The B21t horizon ranges from brown to dark brown in color. The B22t horizon ranges from reddish brown to brown in color. The B23t horizon is reddish brown, brown, or yellowish red. The Btca horizon begins at a depth of 30 to 60 inches. The content of calcium carbonate in this horizon ranges from 20 to 50 percent. The B25t horizon ranges from red to reddish yellow in color. The content of calcium carbonate in this horizon ranges from 5 to 15 percent.

Pullman clay loam, 0 to 1 percent slopes (PuA).—This soil is mainly on broad upland plains. Most areas extend in a continuous pattern over several thousand acres, interrupted only by an occasional playa depression. The dominant slope is about 0.5 percent. This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of Olton, Randall, Lofton, and Estacado soils. Most of these inclusions are less than 5 acres in size.

Most areas of this soil are cultivated and irrigated. Wheat, cotton, grain sorghum, and soybeans are the main crops. Dryland soils are droughty. The hazard of soil blowing is slight.

Application of fertilizers and the return of crop residue to the soil help to control soil blowing and maintain good soil condition. Proper management of irrigation water includes a planned irrigation system. Good recovery systems for runoff irrigation water are useful. In places grassed waterways and diversion terraces are needed to safely carry off excess water.

The dominant climax grasses are blue grama, side-oats grama, and buffalograss. Most areas of this soil are kept in good condition. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is 1,000 to 2,200 pounds per acre. Capability unit IIIe–5, dryland, and IIs–1, irrigated; Deep Hardland range site.

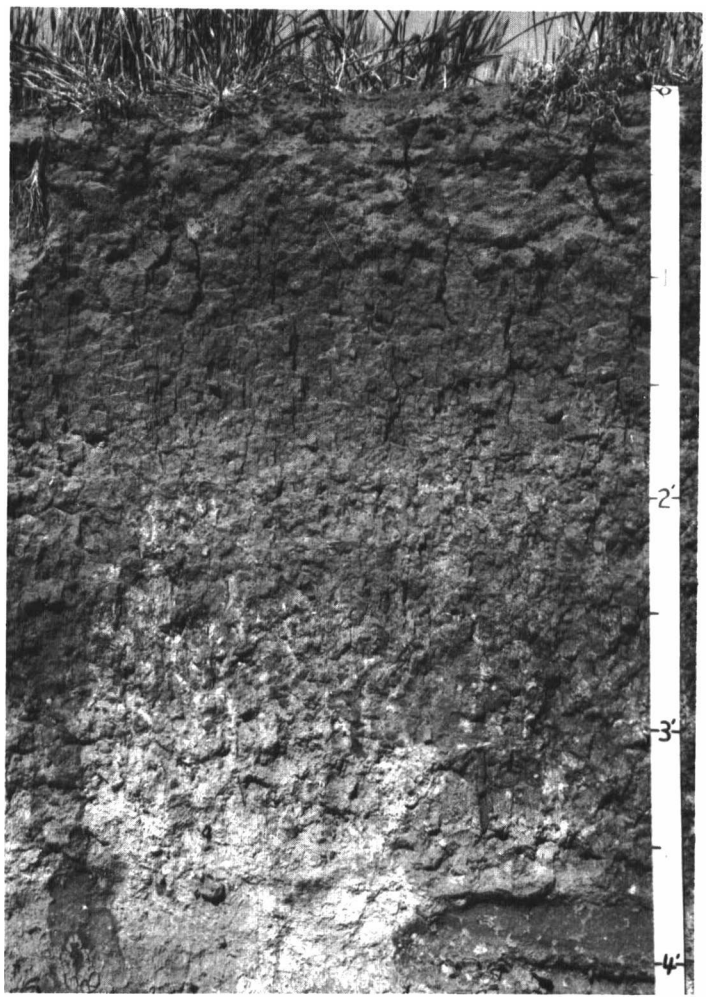

Figure 19.—**Profile of Pullman clay loam, 0 to 1 percent slopes.**

Pullman clay loam, 1 to 3 percent slopes (PuB).—This soil occupies small scattered areas around playa lakes. The areas are narrow and are less than 150 acres in size. The dominant slope is 1 to 2 percent.

The surface layer is brown clay loam about 8 inches thick. The next layer is brown, very firm clay about 34 inches thick. The next lower layer is about 18 inches of pink clay loam that is about 40 percent soft, powdery lime. Below this is reddish-yellow clay loam that is about 20 percent soft, powdery lime.

Included with this soil in mapping are areas of Olton, Estacado, and Mansker soils. These inclusions are less than 10 acres in size. Also included are a few small areas of eroded soils that have a few shallow gullies along drainageways and have a surface layer that is thinner than is normal for this Pullman soil.

Most areas of this soil are cultivated. Wheat and grain sorghum are the main crops. The hazard of water erosion is moderate. Dryland soils are droughty.

Large amounts of crop residue are needed on these soils to control erosion and improve soil condition. In places terraces or waterways are needed to reduce the hazard of water erosion. If this soil is irrigated, a well-designed irrigation system and good water management

are needed. Most irrigated crops respond to applications of fertilizer. Good recovery systems for runoff irrigation water are helpful.

The dominant climax grasses are blue grama, side-oats grama, and buffalograss. Most areas of this soil are kept in good condition. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is 1,000 to 2,200 pounds per acre. Capability unit IIIe–1, dryland, and IIIe–1, irrigated; Deep Hardland range site.

Randall Series

The Randall series consists of deep, somewhat poorly drained clays. These soils are on the bottom of playas that are scattered throughout the county. Most areas are wet or are under water for several weeks of the year in most years. In undisturbed areas the surface is undulating because the soil swells and shrinks upon wetting and drying.

In a representative profile (fig. 20), the surface layer is dark-gray clay about 24 inches thick. The next layer, about 26 inches thick, is gray clay. Below this is light-gray clay that contains a few lime masses.

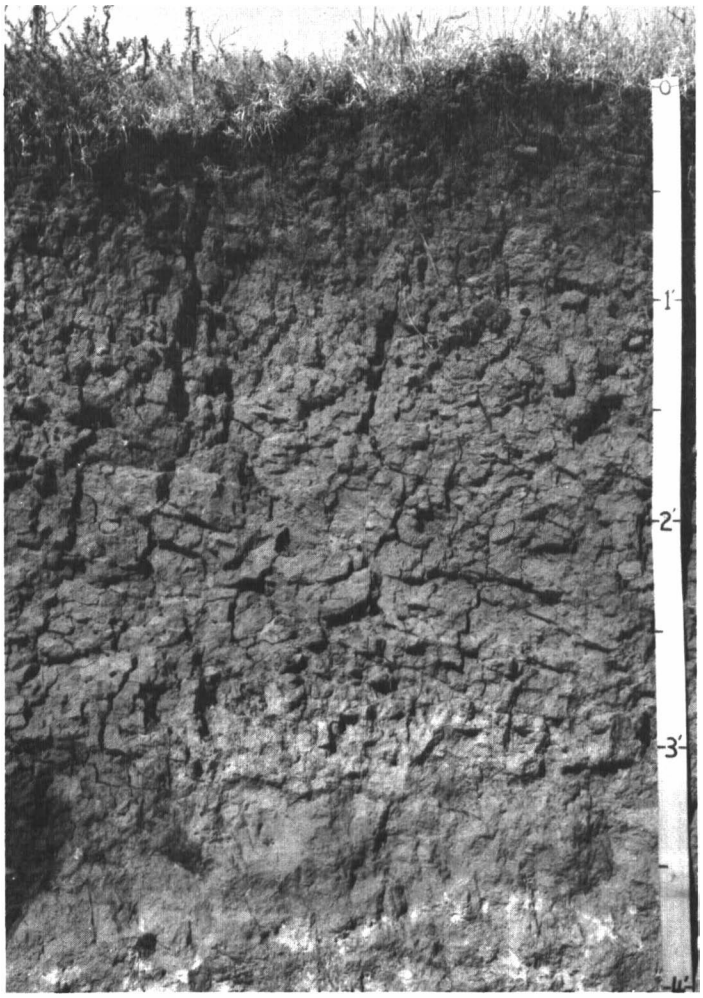

Figure 20.—**Profile of Randall clay. Cracks extend from the surface to a depth of about 50 inches.**

Randall soils are very slowly permeable. They are clayey and difficult to farm and are droughty. Many areas are wet for long periods and support little vegetation. Most areas are suitable as wildlife habitat, especially for ducks and geese.

Representative profile of Randall clay, 0.2 mile east of the northwest corner of section 42, block A–4, EL&RR Railroad Survey, and 200 feet south of road in lake bed (6 miles south on U.S. Highway 87 from Hale Center, then 5.2 miles east of juncture, on Farm Road 37.)

A1—0 to 24 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) when moist; moderate, fine, blocky and medium, granular structure; very hard, firm; upper 3 inches is browner colored overwash material; common wedge-shaped peds in lower part; vertical lenses of lighter colored material in cracks; few prominent mottles of yellowish brown; few, fine, shotlike concretions of iron and manganese; calcareous; moderately alkaline; diffuse, wavy boundary.

AC1—24 to 36 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) when moist; weak, fine and medium, blocky structure but tends toward massive when wet; very firm; vertical cracks extend throughout layers; distinct intersecting slickensides; common wedge-shaped peds; few, fine, prominent mottles of yellowish brown; calcareous; moderately alkaline; diffuse, wavy boundary.

AC2—36 to 50 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) when moist; weak, medium, blocky structure but tends toward massive when wet; about 30 percent of the mass is large prominent mottles of light gray (2.5Y 6/1) when moist; calcareous; moderately alkaline; diffuse, wavy boundary.

C—50 to 66 inches, light-gray (10YR 7/1) clay, light gray (10YR 6/1) when moist; massive; few mottles of yellowish brown; few lenses of dark-gray (10YR 4/1) material, probably from cracks extending to this depth; few soft calcium carbonate masses; calcareous; moderately alkaline.

The A1 horizon ranges from 12 to 25 inches in thickness and from gray to very dark gray in color. This horizon ranges from neutral to moderately alkaline. The overwash material ranges from 0 to 8 inches in thickness. The AC horizon is dark gray to gray. The C horizon ranges from gray to light gray. Content of segregated calcium carbonate ranges from faint films and threads to 5 or 10 percent in form of soft lumps.

Randall clay (Ra).—This soil is on the bottom of playas or in enclosed depressions. Most areas are oval and have smooth boundaries. The areas generally are 5 to 50 acres in size, but a few areas are larger. Slope is dominantly less than 0.3 percent. The areas are low on the landscape and receive water from runoff. Most areas are wet for several weeks of the year.

Included with this soil in mapping are areas of Lofton, Arch, and Estacado soils. These inclusions are small and occur as narrow bands around the edge of areas of this soil.

This soil is droughty. It cracks readily when dry, and its permeability is very slow when the cracks fill with water. The hazard of soil blowing is severe in dry, bare areas.

This soil is not well suited to cultivation. A few areas that are either drained or protected from inflowing water are successfully farmed. Small grain is the main crop.

The native vegetation in the wetter areas consists of sedges, smartweed, blueweed, and other water-tolerant plants. Capability unit VIw–1, dryland; not placed in a range site.

Springer Series

The Springer series consists of deep, nearly level to gently sloping loamy fine sands that formed in eolian material.

In a representative profile, the surface layer is reddish-brown, loose loamy fine sand about 12 inches thick. The next layer is reddish-brown, very friable fine sandy loam about 38 inches thick. Below this layer is 15 inches of light reddish-brown, loose loamy fine sand. This is underlain, to a depth of about 84 inches, by reddish-brown sandy clay loam.

The Springer soils have a moderate available water capacity. Permeability is moderately rapid. The hazard of soil blowing is severe.

Most areas of these soils have been cultivated, but some of these areas have been returned to grass or are idle. Most areas in cultivation are irrigated. Some areas are in irrigated pasture, and they are well suited to this use. A few areas are in native range.

Representative profile of Springer loamy fine sand, 0 to 3 percent slopes, 0.45 mile east of the southwest corner of section 67, block A–3, EL&RR Railroad Survey, and 300 feet north in field (2.6 miles west of the intersection of Farm Roads 1914 and 594, on county road, then 1.0 mile south):

Ap—0 to 12 inches, reddish-brown (5YR 5/4) loamy fine sand, reddish brown (5YR 4/4) when moist; single grain (structureless); loose; neutral; abrupt, smooth boundary.

B2t—12 to 24 inches, reddish-brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) when moist; weak, coarse, prismatic structure; slightly hard, very friable; many fine pores; common worm casts; mildly alkaline; gradual, wavy boundary.

B3—24 to 50 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) when moist; weak, coarse, prismatic structure; slightly hard, very friable; few thin bands of light sandy clay loam; mildly alkaline; gradual, wavy boundary.

A'2—50 to 65 inches, light reddish-brown (5YR 6/4) loamy fine sand, reddish brown (5YR 4/4) when moist; single grain (structureless); loose; mildly alkaline; clear, wavy boundary.

B'21t—65 to 77 inches, reddish-brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) when moist; weak, fine and medium, subangular blocky structure; hard, friable; mildly alkaline; gradual, smooth boundary.

B'22t—77 to 84 inches, reddish-brown (5YR 4/3) sandy clay loam, dark reddish brown (5YR 3/3) when moist; moderate, medium, blocky structure; very hard, firm; clay films on peds; mildly alkaline.

The A horizon ranges from 10 to 18 inches in thickness and from brown to reddish brown in color. The B2t horizon is red, yellowish red, or reddish brown. The B3 horizon is red, yellowish red, or reddish brown. The A'2 horizon begins at a depth of 30 to 60 inches. The B'2t horizon is sandy clay loam or fine sandy loam.

Springer loamy fine sand, 0 to 3 percent slopes (SpB).—This soil has slopes that are mainly about 1 percent. It is in close association with the Tivoli and Brownfield soils.

Included with this soil in mapping are areas of Amarillo, Brownfield, and Tivoli soils. These inclusions are less than 10 acres in size. Also included is a small acreage of this Springer soil that is severely blown, consisting of small spots of shallow blowouts and low dunes that have a billowy or undulating surface.

Most areas of this soil have been cultivated, but many areas are now in grass. A few areas are idle. The severe hazard of soil blowing makes these soils unsuitable for cultivation, unless they are irrigated.

This soil should be in native grass. Where this soil is irrigated, forage sorghum and grain sorghum are the main crops. Some areas are in bermudagrass pasture. Good management is needed to control soil blowing. Effective practices are continuously growing a close-spaced crop that produces residue and using fertilizer. Limited tillage using stubble mulch is needed to control erosion. In places areas of this soil that are undulating or hummocky need smoothing of the surface so that sprinkler irrigation systems can effectively apply controlled amounts of irrigation water. Irrigation pipelines are needed if water is to be moved from one location to another.

Effective management of pastureland consists of use of fertilizer, frequent irrigation from a properly designed system, rotational grazing, and proper grazing management.

The dominant climax grasses are sand bluestem, little bluestem, switchgrass, and sand dropseed. Other important grasses are side-oats grama, giant dropseed, sand lovegrass, and silver bluestem. Plants that invade are sand sagebrush, ragweed, wild buckwheat, broom snakeweed, and annual grasses. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is about 1,800 to 3,350 pounds per acre. Capability unit VIe–1, dryland, and IVe–2, irrigated; Sandyland range site.

Tivoli Series

The Tivoli series consists of deep, gently sloping to steep fine sands that formed in thick, sandy eolian material.

In a representative profile (fig. 21), the surface layer is pale-brown fine sand about 8 inches thick. Below this is reddish-yellow, loose fine sand. The topography is characterized by dunes.

Tivoli soils are excessively drained. They have a low available water capacity. Permeability is rapid. The hazard of soil blowing is severe.

These soils are used for native range.

Representative profile of Tivoli fine sand, 5 miles north of Cotton Center on Farm Road 594, 3 miles west on county road and 1 mile west into pasture:

A1—0 to 8 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 5/3) when moist; single grain (structureless); loose; many fine roots; neutral; gradual, wavy boundary.

C—8 to 60 inches, reddish-yellow (7.5YR 6/6) fine sand, strong brown (7.5YR 5/6) when moist; single grain (structureless); loose; many fine roots in upper part; neutral.

The A horizon ranges from 4 to 10 inches in thickness and from light brown or brown to yellowish brown in color. The C horizon ranges from pale brown to reddish yellow. Reaction in this horizon is neutral to moderately alkaline.

Tivoli fine sand (Tv).—This gently sloping to steep soil has a topography characterized by dunes. Most of the dunes are 10 to 30 feet high. They are long and narrow and extend mostly from west to east. The slope on the sides of dunes is 3 to 35 percent.

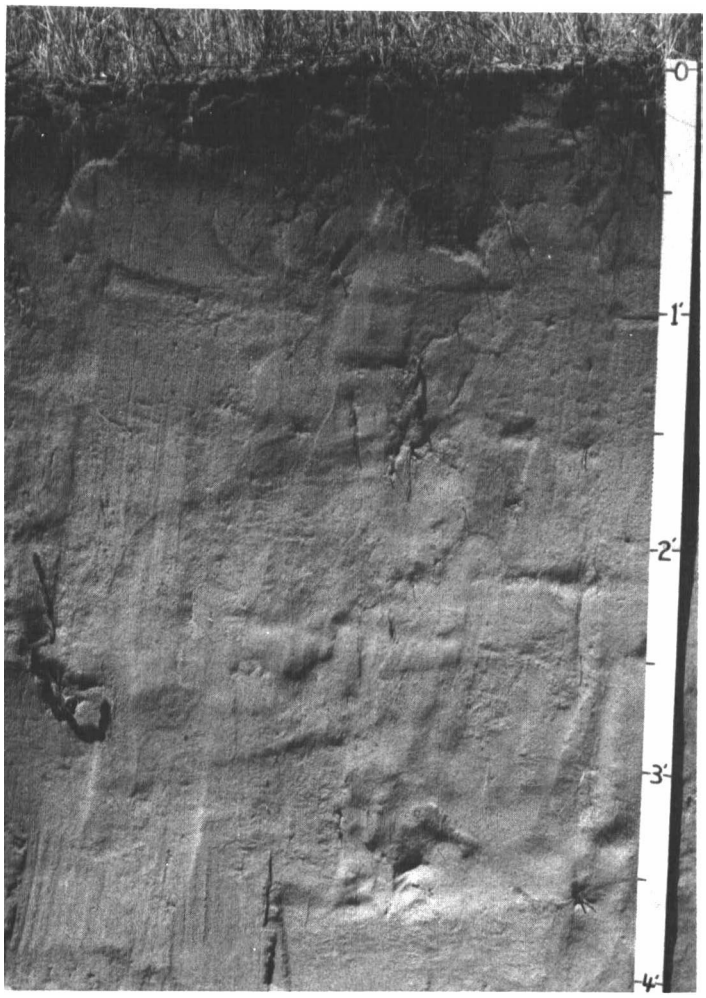

Figure 21.—**Profile of Tivoli fine sand. Uppermost 6 to 8 inches is darkened by accumulated organic matter.**

Included with this soil in mapping are several small areas of active dunes. These areas have similar topography, but they lack a vegetative cover. Most areas are 1 to 5 acres in size. Also included are small areas of Brownfield and Amarillo soils. These inclusions are less than 10 acres in size.

This soil is better suited to range or wildlife habitat than to most other uses.

The dominant climax grasses are sand bluestem, indiangrass, switchgrass, little bluestem, sand lovegrass, and sand reedgrass. Other important grasses are sideoats grama, giant dropseed, silver bluestem, three-awn, and sand dropseed. The more common invaders are gummy lovegrass, tumblegrass, red lovegrass, tumble windmillgrass, yucca, sand sagebrush, skunkbush, shin oak, ragweed, and annual grasses. A good protective cover should be maintained at all times because the hazard of soil blowing is severe. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is about 1,500 to 3,200 pounds per acre. Capability unit VIIe–1, dryland; Deep Sand range site.

Zita Series

The Zita series consists of deep, nearly level to gently sloping loams that occur within the basins of the larger playa lakes. They formed in calcareous loamy material.

In a representative profile (fig. 22), the surface layer

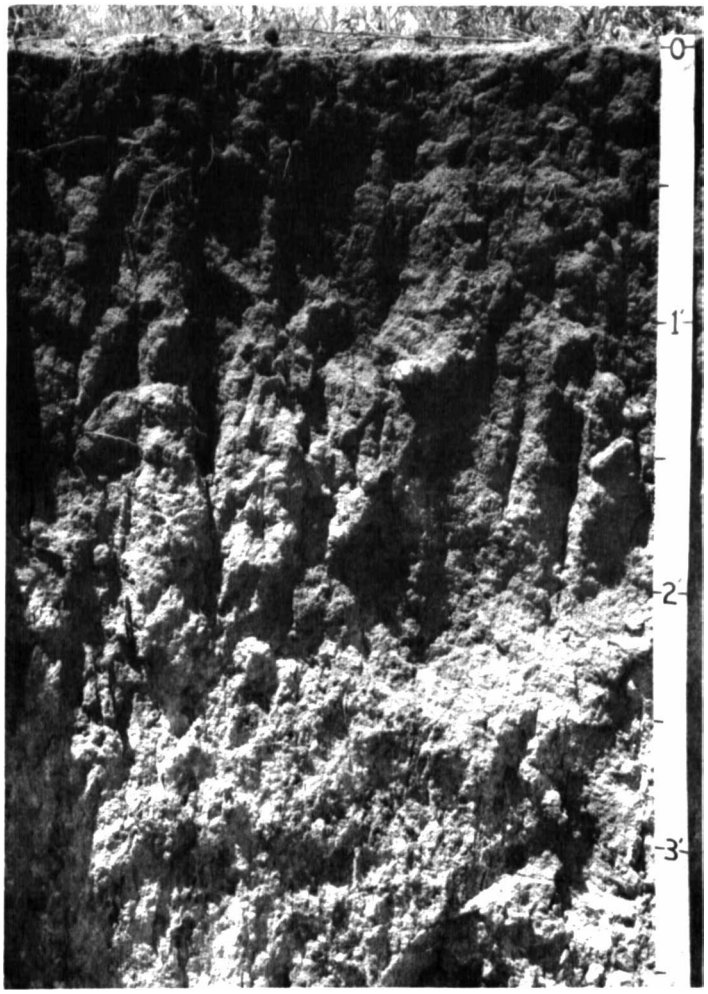

Figure 22.—**Profile of Zita loam, 0 to 1 percent slopes. Weak calcic horizon begins at a depth of about 30 inches.**

is dark grayish-brown loam about 12 inches thick. The next layer is grayish-brown, friable clay loam about 20 inches thick. The next lower layer is 28 inches of light brownish-gray clay loam that is about 15 to 20 percent soft, powdery lime. Below this is light brownish-gray clay loam that is about 5 percent soft, powdery lime.

Zita soils have a high available water capacity. Permeability is moderate.

Most areas of Zita soils are cultivated, and many areas are in irrigated cropland. A few areas are in native range.

Representative profile of Zita loam, 0 to 1 percent slopes, 0.2 mile north of the southwest corner of section 21, block D–7, D&F Railroad Survey, and 100 feet east of road into pasture (6.0 miles east of Hale Center on Farm Road 1914, and 0.8 mile south on county road) :

A1—0 to 12 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, granular structure; hard, very friable; moderately alkaline; clear, smooth boundary.

B2—12 to 32 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; many pores and worm casts; calcareous; moderately alkaline; gradual, wavy boundary.

C1ca—32 to 60 inches, light brownish-gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) when moist; massive (structureless); hard, very friable; visible, soft, powdery lime makes up about 15 to 20 percent of soil mass; calcareous; moderately alkaline; gradual, wavy boundary.

C2—60 to 72 inches, light brownish-gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) when moist; massive (structureless); hard, friable; about 5 percent visible calcium carbonate; calcareous; moderately alkaline.

The A horizon ranges from 10 to 20 inches in thickness and from brown to dark grayish brown in color. The B horizon ranges from brown to dark grayish brown in color. The average clay content between depths of 10 and 40 inches is 25 to 35 percent. Visible calcium carbonate ranges from a few films and threads to 5 percent or more soft, powdery masses. The C horizon begins at a depth of 30 to 60 inches. It ranges from light gray or light brownish gray to white in color. Visible calcium carbonate ranges from 5 to 40 percent, mostly in soft, powdery masses.

Zita loam, 0 to 1 percent slopes (ZmA).—This soil occupies areas in depressions of playa lakes. The average slope is about 0.5 percent. Most areas are 10 to 80 acres in size. This soil has the profile described as representative for the series.

Included with this soil in mapping are areas of Estacado, Acuff, and Lofton soils. Also included are a few small areas that have a fine sandy loam surface layer and a few areas that have dark, clayey, buried layers at depth of 3 to 5 feet.

Most areas of these soils are in irrigated cropland. Most areas occupy low positions and receive runoff water from surrounding soils. The hazard of soil blowing is slight.

Management consists of leaving crop residue on the surface during the critical periods of soil blowing. Timely and limited tillage and use of terraces, diversion terraces, and grassed waterways are also needed. If this soil is irrigated, a well-designed irrigation system, good water management, and fertilization are needed. Effective practices on pastureland and hayland are scheduled rest periods from grazing and mowing, proper utilization heights, fertilization, and frequent irrigation.

The dominant climax grasses are blue grama, side-oats grama, and buffalograss. Most areas of this soil are kept in good condition. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is 1,300 to 2,200 pounds per acre. Capability unit IIIe–4, dryland, and IIe–1, irrigated; Deep Hardland range site.

Zita loam, 1 to 3 percent slopes (ZmB).—This soil occupies areas in basins of playa lakes. The areas are about 10 to 50 acres in size. The slope averages about 1.5 percent.

The surface layer is dark grayish-brown loam about 14 inches thick. The next layer is grayish-brown, friable clay loam about 18 inches thick. The next lower layer is 20 inches of light brownish-gray clay loam that is about 20 percent soft masses of lime. Below this is light brownish-gray clay loam that is about 10 percent soft masses of lime.

Included with this soil in mapping are areas of Estacado, Acuff, and Lofton soils and a few areas of soils that have a fine sandy loam surface layer. These inclusions are less than 10 acres in size. Also included are a few areas of soils that have erosion damage and have shallow gullies.

Most areas of this soil are in cropland. Wheat, cotton, and grain sorghum are the main crops. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Crop residue managed on the surface is needed to help control erosion and soil blowing. Terracing and contour farming are needed to reduce water erosion. In places diversion terraces and grassed waterways are needed to safely carry off excess runoff water. Irrigated crops respond to fertilization and controlled application of irrigation water in a properly designed irrigation system.

The dominant climax grasses are blue grama, side-oats grama, and buffalograss. Most areas of this soil are kept in good condition. Depending on variations in rainfall, the total annual production of air-dry herbage on range in excellent condition is 1,300 to 2,200 pounds per acre. Capability unit IIIe–2, dryland, and IIIe–2, irrigated; Deep Hardland range site.

Use and Management of the Soils

This section explains the system of capability grouping used by the Soil Conservation Service to classify soils according to suitability for crops, and it defines the capability units established in Hale County; it shows the yields to be expected from those soils suitable for crops, with irrigation and without irrigation; it discusses the classification of soils into range sites and defines the range sites established in Hale County; it shows the relative suitability of general areas of the county for management as wildlife habitat; and it presents a summary of soil characteristics that affect engineering practices and interpretations of these characteristics in terms of specific uses. Management of an individual soil if used for farming or ranching is discussed under the name of the soil in the section "Descriptions of the Soils." The capability unit and range site of each soil are given at the end of the soil description and also in the "Guide to Mapping Units" at the back of this survey.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects;

and does not apply to horticultural crops or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range or engineering.

In the capability system, the kinds of soils are grouped at three levels: the capability class, the subclass, and the unit. These are discussed in the following paragraphs.

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use. (None in Hale County.)

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife habitat. (None in Hale County.)

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, or water supply, or to esthetic purposes. (None in Hale County.)

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c* shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife habitat, or recreation.

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–2 or IIIe–4. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

The capability classifications for each soil in Hale County are listed at the end of the mapping unit description in the section "Descriptions of the Soils," and also in the "Guide to Mapping Units." Suggestions for the use and management of the soils are given in the soil descriptions.

In the following pages the capability units in Hale County are briefly described.

Capability Units for Dryland Soils

Unit IIe–1.—Deep, nearly level, moderately permeable loams.

Unit IIIe–1.—Deep, gently sloping, very slowly permeable clay loams.

Unit IIIe–2.—Deep, gently sloping, moderately permeable and moderately slowly permeable loams.

Unit IIIe–3.—Deep, nearly level to gently sloping, moderately permeable fine sandy loams.

Unit IIIe–4.—Deep, nearly level, moderately permeable and moderately slowly permeable loams.

Unit IIIe–5.—Deep, nearly level, very slowly permeable clay loams.

Unit IVe–1.—Nearly level to gently sloping, moderately permeable loams over layers that are high in content of lime.

Unit IVe–2.—Deep, nearly level to gently sloping, moderately permeable loams and fine sandy loams.

Unit IVe–3.—Deep, gently sloping, moderately permeable fine sandy loams.

Unit IVe–4.—Deep, gently sloping, moderately permeable clay loams.

Unit IVe–5.—Deep, nearly level to gently sloping, moderately permeable loamy fine sands.

Unit IVe–6.—Deep, gently sloping, moderately permeable loams and fine sandy loams.

Unit VIe–1.—Deep, nearly level to gently sloping and gently undulating, moderately permeable and moderately rapidly permeable fine sands and loamy fine sands.

Unit VIe–2.—Deep, sloping, moderately permeable loams.

Unit VIe–3.—Deep, gently sloping to sloping, moderately permeable sandy clay loams and clay loams.

Unit VIw–1.—Deep, nearly level, very slowly permeable clays that occupy playa depressions.
Unit VIIe–1.—Deep, gently sloping to steep, rapidly permeable fine sands.
Unit VIIs–1.—Very shallow to shallow over caliche, gently sloping to sloping, moderately permeable gravelly loams.

CAPABILITY UNITS FOR IRRIGATED SOILS

Unit IIe–1.—Deep, nearly level, moderately permeable and moderately slowly permeable loams.
Unit IIe–2.—Deep, nearly level, moderately permeable fine sandy loams.
Unit IIs–1.—Deep, nearly level, very slowly permeable clay loams.
Unit IIIe–1.—Deep, gently sloping, very slowly permeable clay loams.
Unit IIIe–2.—Deep, gently sloping, moderately permeable and moderately slowly permeable loams.
Unit IIIe–3.—Deep, gently sloping, moderately permeable fine sandy loams and clay loams.
Unit IIIe–4.—Nearly level to gently sloping, moderately permeable loams over layers that are high in content of lime.
Unit IIIe–5.—Deep, nearly level to gently sloping, moderately permeable loamy fine sands.
Unit IIIe–6.—Deep, nearly level to gently sloping, moderately permeable loams and fine sandy loams.
Unit IIIe–7.—Deep, gently sloping to sloping, moderately permeable sandy clay loams and clay loams.
Unit IVe–1.—Deep, gently sloping, moderately permeable fine sandy loams.
Unit IVe–2.—Deep, nearly level to gently sloping and gently undulating, moderately permeable and moderately rapidly permeable fine sands and loamy fine sands.
Unit IVe–3.—Deep, gently sloping, moderately permeable loams and fine sandy loams.

Management of Dryfarmed Cropland

Management of the soils of Hale County is needed mainly to control soil blowing, to conserve moisture, and to control water erosion. The main factor affecting management is climate. Rainfall is variable but is generally low, droughts are severe, and there are occasional intensive rains, high winds, and hailstorms.

Control of soil blowing.—The use of the soils as cropland is hazardous unless practices to control soil blowing are followed.

The cropland can be most effectively protected against soil blowing by leaving a protective cover of crop residue on the surface during the critical dry, windy seasons of fall, winter, and spring (fig. 23). After the critical period, the crop residue can be plowed into the soil.

Stubble mulching is another practice used to manage the residue for protection against soil blowing. A protective cover of residue from the crop is left on the soil surface until the next crop is planted, and planting is done in the stubble (fig. 24).

***Figure 23.*—Grain sorghum residue left on the surface of an Olton loam for control of soil blowing.**

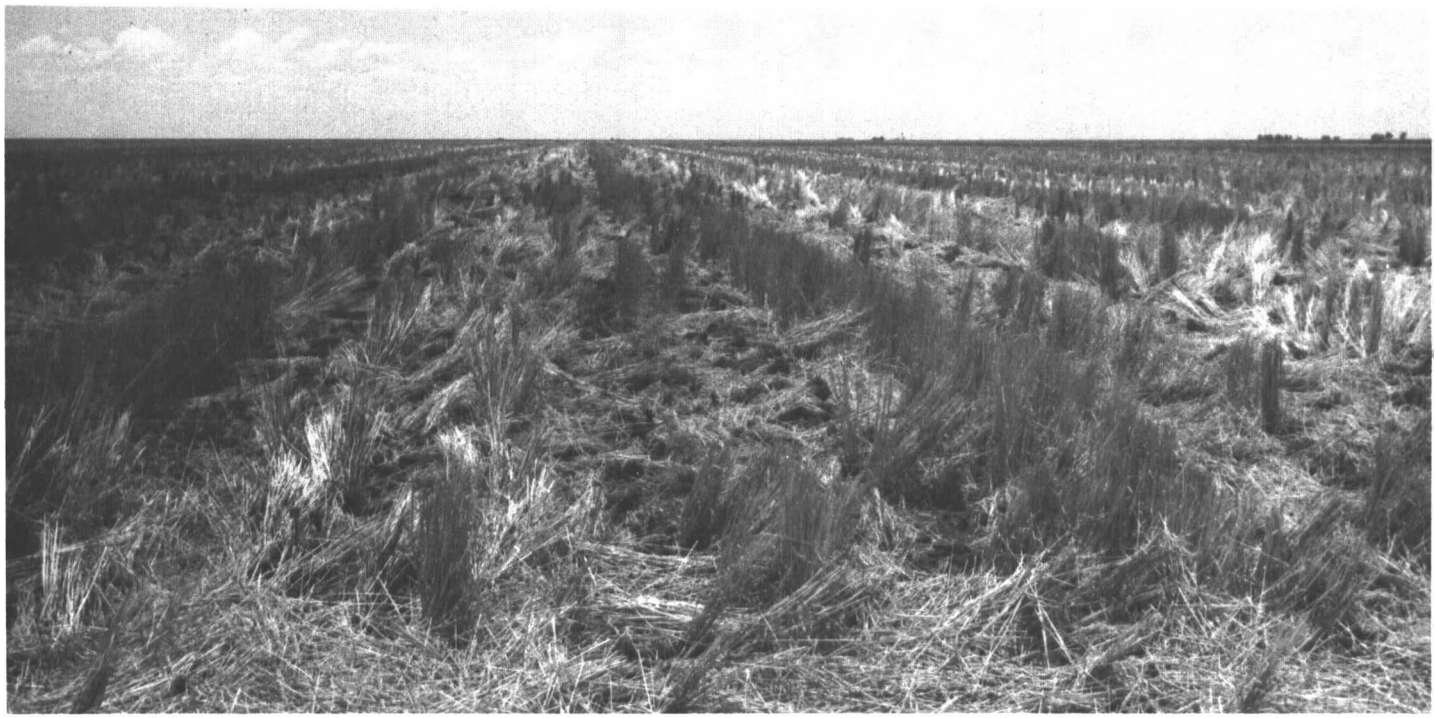

Figure 24.—Small grain residue left on the surface following tillage for control of soil blowing. The soil is a Pullman clay loam.

Mulching, or applying organic waste, is also effective in controlling soil blowing. This practice consists of placing organic material on the soil to protect it. Cotton burrs and gin trash are widely used. Applications of at least 3 tons per acre can effectively control soil blowing on most soils in the county.

If there is not enough crop residue on the soil to protect it adequately, an emergency practice is to roughen the surface of the soil and make it cloddy.

Conservation of moisture and control of water erosion.—An effective practice for reducing water erosion is keeping crop residue or organic residue on the surface. It is effective on all the soils in the county. This practice conserves moisture by reducing evaporation and increasing water intake.

Terracing and contour farming are effective in conserving moisture by reducing runoff and allowing more water to enter the soil. Farmers use terraces to control water erosion on the steeper soils. In places, diversion terraces are used to control outside water.

Grassed waterways (fig. 25) help to control erosion by carrying runoff water at a safe, nonerosive rate. This is water that has collected in natural drainageways, terraces, and diversion terraces. Grassed waterways should be protected from grazing and fire.

Management of Irrigated Cropland

Most of the soils in Hale County in cultivation are suitable for irrigation. Many of them are irrigated where water is available. Surface irrigation systems are most widely used. A few soils, such as Amarillo, Brownfield, and Springer, are suitable only for sprinkler irrigation. The nearly level, smooth soils, such as the Pullman, Olton, and Lofton, are well suited to graded-furrow irrigation, which is the method most commonly used on these soils. Most areas require only a little leveling or smoothing of the surface before they are irrigated. Many areas of the more sloping soils are leveled to get better distribution of irrigation water. Some of the more sloping soils are terraced and sprinkler irrigated.

The main crops grown on irrigated cropland in Hale County are cotton, grain sorghum, wheat, soybeans, alfalfa, bermudagrass, and vegetables. The acreage of vegetables is increasing, and the most common vegetables are onions, potatoes, peppers, cucumbers, and carrots.

Management needs for the control of soil blowing and water erosion are about the same for irrigated soils and dryland soils. Essentially the same cropping systems are used for dryland and irrigated soils. On irrigated soils, however, a better soil-improving and fertility program is needed because the crops are higher yielding and deplete the soil of plant nutrients. The additional water enables growing a wider variety of crops in the cropping system. More residue can be produced, and cover crops can be grown to add protection to the soil during the critical period of soil blowing.

The most practical way to improve and to maintain fertility and productivity is to return large amounts of fertilized crop residue to the soil. Nitrogen fertilizer applied on crop residue helps to decompose it. This prevents a nitrogen shortage in the crop that follows. Fertilizer is needed on most irrigated soils in Hale County. Fertilizers should be applied according to soil tests. Nitrogen and phosphorus are the nutrients most likely to be needed.

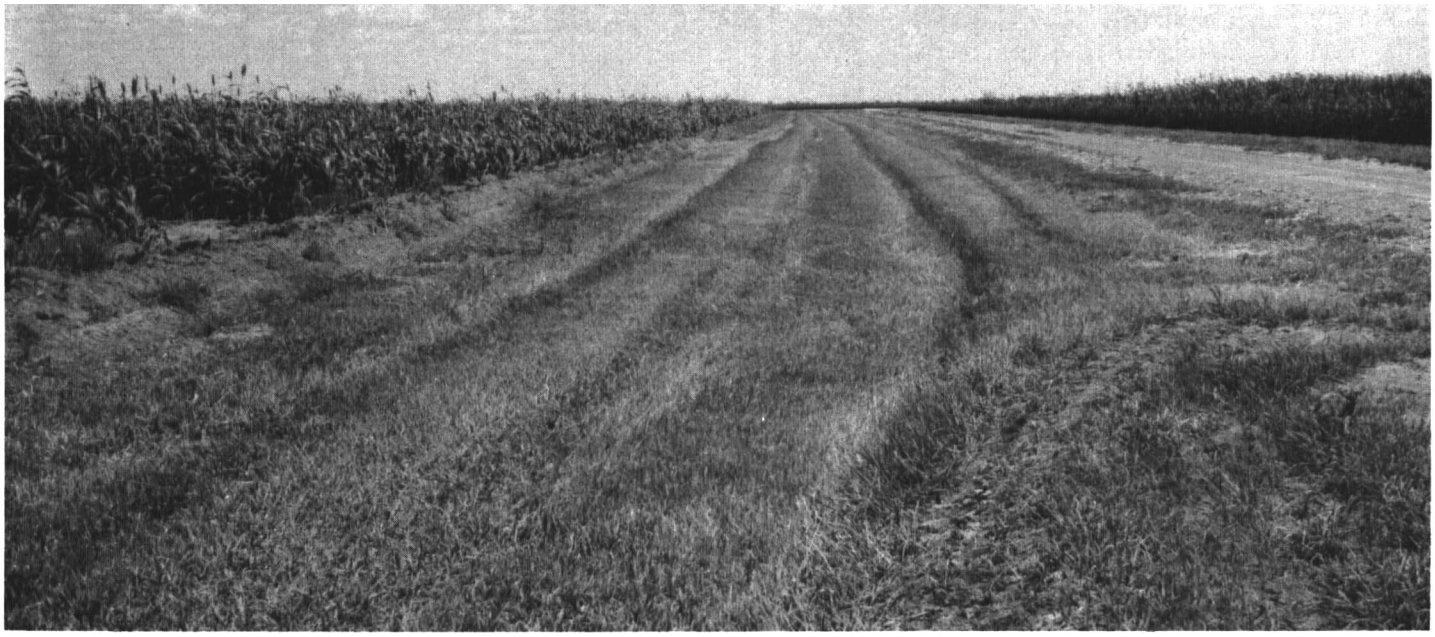

Figure 25.—**Grassed waterway in an area of an Olton loam. The waterway has a good cover of native vegetation.**

The main management concern on irrigated soils is applying water in such a way that water is not wasted and erosion is not encouraged. It must be applied in amounts determined by the kind of soil and needs of the crops grown.

Yield Predictions

Predicted yields are shown in table 2 for soils in Hale County that are mostly used for cropland. The estimated yields are provided for a high level of management only. This level of management represents the better soil, plant, and water management practices.

Under high-level management of dryfarmed soils—

1. Precipitation is conserved.
2. Crops are rotated. Close-growing and soil-protecting crops are alternated with clean-tilled and erosion-permitting crops.
3. Residue from crops is left on the soil surface during critical periods of erosion.
4. Soil tillage is timely and is held to a minimum.
5. Terraces, diversions, and grassed waterways are used where needed. Contour farming follows terraces and guidelines.

Under high-level management of irrigated soils—

1. Precipitation is conserved.
2. Crops are rotated. Soil-protecting and soil-improving crops are alternated with clean-tilled and erosion-permitting crops.
3. Fertilizer is used to meet crop needs.
4. Residue from crops is left on or near the surface during critical periods of erosion.
5. Soil tillage is timely and is held to a minimum.
6. An irrigation system is installed to efficiently distribute irrigation water without wasting water or encouraging erosion.
7. Irrigation water is applied according to soil characteristics and crop growth requirements.

Under high-level management of pastureland and hayland—

1. Adapted perennial grasses and legumes are used to satisfy forage requirements of livestock.
2. Grazing and cutting heights of forage plants are controlled to maintain plant productivity and provide cover for erosion control.
3. Fertilizer is applied to satisfy soil, plant, and livestock needs.
4. Management facilities, including pens, water facilities, and fences, are properly located to permit efficient application of locally approved plant and livestock management techniques.

Range Management

Native range covers about 4 percent of Hale County. The largest tract of range is in the sandhills region in the western part of the county. Small tracts of range are scattered throughout the county. Many of these areas are associated with playa lakes.

The raising of livestock in Hale County is secondary to cotton, grain sorghum, and small grain farming. One ranch and about 25 livestock farms are in operation. On many farms, irrigated pastures have been developed as a source of feed for livestock. Small grain, forage sorghum, and the stubble of grain sorghum are the main crops used for grazing.

The most common livestock operation in the county is the stocker cattle enterprise. In this enterprise, stocker cows and calves are brought in to utilize feed where it is available. There are a few cow-calf operations that primarily consist of producing calves to be marketed at weaning time. Feedlot operations are on the increase,

TABLE 2.—*Predicted average acre yields of principal crops, dryfarmed and irrigated, under high-level management*

[Soils not used mainly for crops are not listed. Dashes in a column indicate that the particular crop is not grown on the soil named]

Soil	Dryfarmed			Irrigated				
	Cotton	Grain sorghum	Wheat	Cotton	Grain sorghum	Wheat	Soybeans	Alfalfa
	Pounds of lint	*Pounds*	*Bushels*	*Pounds of lint*	*Pounds*	*Bushels*	*Bushels*	*Tons*
Acuff loam, 0 to 1 percent slopes	200	1,250	18	850	7,200	55	33	6
Acuff loam, 1 to 3 percent slopes	175	1,250	16	800	6,000	50	29	5
Amarillo fine sandy loam, 0 to 1 percent slopes	180	1,100	14	880	6,600	60	25	6
Amarillo fine sandy loam, 1 to 3 percent slopes	175	1,000	13	850	6,000	50	24	6
Amarillo fine sandy loam, 3 to 5 percent slopes	150	800	10	600	4,500	35		4
Amarillo loamy fine sand, 0 to 3 percent slopes	175	1,000	12	800	5,500			5
Arch loam, 0 to 3 percent slopes		650	9	600	3,600	45		5
Berda loam, 3 to 5 percent slopes		750	9		3,300	27		
Bippus fine sandy loam, overwash, 0 to 1 percent slopes	180	1,100	14	880	6,600	60	30	6
Bippus fine sandy loam, overwash, 1 to 3 percent slopes	165	1,000	13	850	6,000	50	24	5
Bippus loam, 0 to 1 percent slopes	250	1,200	16	850	7,200	65	35	6
Bippus loam, 1 to 3 percent slopes	225	1,000	14	800	6,000	50	30	5
Brownfield fine sand					3,600			4
Drake clay loam, 1 to 3 percent slopes		600	10	700	4,600	45		5
Drake soils, 3 to 8 percent slopes					3,000	32		4
Estacado loam, 0 to 1 percent slopes	175	1,100	14	800	6,000	50	30	5.5
Estacado loam, 1 to 3 percent slopes	160	900	12	750	5,000	45	25	5
Lofton clay loam	190	1,000	15	825	6,600	55	35	5.5
Mansker loam, 0 to 3 percent slopes	150	900	12	650	3,600	30		4
Mansker loam, 3 to 5 percent slopes	120	700	10		2,700	24		
Midessa fine sandy loam, 0 to 1 percent slopes	150	1,000	14	850	6,000	55	25	5
Midessa fine sandy loam, 1 to 3 percent slopes	150	1,000	12	800	4,800	45	22	4
Olton loam, 0 to 1 percent slopes	200	1,200	15	850	7,200	55	35	5.5
Olton loam, 1 to 3 percent slopes	175	1,000	13	800	6,000	50	30	5
Posey fine sandy loam, 0 to 3 percent slopes	130	750	10	650	4,000	30		
Posey fine sandy loam, 3 to 5 percent slopes	100	600	8	500	3,000	21		
Pullman clay loam, 0 to 1 percent slopes	170	900	14	825	6,600	55	35	5.5
Pullman clay loam, 1 to 3 percent slopes	165	750	13	800	6,000	45	28	5
Springer loamy fine sand, 0 to 3 percent slopes				750	4,000			
Zita loam, 0 to 1 percent slopes	180	1,250	16	850	7,200	60	33	6
Zita loam, 1 to 3 percent slopes	165	1,000	13	800	6,600	55	29	5

and there are a number of large commercial feedlots in the county. Most feed for this enterprise is locally grown grain and silage.

Range sites and condition classes

Soils are grouped into range sites on the basis of similarity in the kind and quantity of native forage plants that they produce. Each site has a distinctive potential, or climax, plant community, the composition of which depends on a combination of environmental factors, including soil, topography, and climate. The potential plant community reproduces itself so long as the environment remains undisturbed.

Eight range sites are recognized in Hale County. The plant community on each of these sites differs from that on the other seven in such a way and to such a degree as to necessitate a difference in management. The range sites in the county are identified as follows:

Deep Hardland site.—Deep, nearly level to gently sloping, moderately permeable to very slowly permeable loams and clay loams.

Deep Sand site.—Deep, nearly level to steep and gently undulating, moderately permeable to rapidly permeable fine sands.

Hardland Slopes site.—Deep, nearly level to sloping, moderately permeable loams.

High Lime site.—Shallow to deep over lime, nearly level to sloping, moderately permeable loams and clay loams.

Mixedland Slopes site.—Deep, nearly level to gently sloping, moderately permeable fine sandy loams.

Sandyland site.—Deep, nearly level to gently sloping, moderately permeable to moderately rapidly permeable loamy fine sands.

Sandy Loam site.—Deep, nearly level to gently sloping, moderately permeable fine sandy loams.

Very Shallow site.—Very shallow to shallow over caliche, gently sloping to sloping, moderately permeable gravelly loams.

The range site of each soil in the county is shown at the end of the description of the mapping unit in the section "Descriptions of the Soils," and in the "Guide to Mapping Units," at the back of the survey. Information about the composition of the native vegetation and the productivity of each soil is also given in the section "Descriptions of the Soils."

Range condition is the present state of the vegetation of a range site in relation to the potential plant cover for that site. Range condition classes measure the degree to which the present plant composition, expressed in percent, resembles that of the potential plant community of a range site. Four range condition classes are recog-

nized: excellent, good, fair, and poor. A range is in excellent condition if 76 to 100 percent of the existing vegetation is of the same composition as that of the potential stand. It is in good condition if the percentage is between 51 and 75, in fair condition if the percentage is between 26 and 50, and in poor condition if the percentage is less than 26.

The plants on any given range site are grouped according to their response to grazing, as decreasers, increasers, and invaders. Decreasers are plants in the potential plant community that decrease in relative abundance if the community is subjected to continued moderately heavy to heavy grazing. Most of these kinds of plants have a high grazing preference and decrease from excessive use. The total of all such species is counted in determining range condition class.

Increasers are plants in the potential plant community that normally increase as decreasers decline. Some increasers that have moderately high grazing preference initially increase and then decrease as grazing pressure continues. Others of low grazing preference continue to increase in actual plant numbers or in relative proportions. Only the percentages of increaser plants normally expected to occur in the potential plant community are counted in determining range condition.

Invader plants are not members of the potential plant community for the site. They invade the community as a result of various kinds of disturbance. They can be annuals or perennials and can be grasses, weeds, or woody plants. Some invaders have relatively high grazing value, but many are worthless. Invader plants are not counted in determining range condition class. Most of the native grasslands of Hale County have been heavily grazed for several generations, and their original plant cover has been materially altered.

Wildlife

Most of Hale County is nearly level to gently sloping, treeless prairie. It is dissected by two intermittent streams. Numerous playa lakes are scattered throughout the county. A small area of sandhills are in the western part. Most of the county is cultivated.

Wildlife was once abundant in Hale County, but most of it was killed off after the area was settled and the soils were cultivated. Antelope, prairie dogs, and quail were once abundant. The antelope are now extinct, and only a few quail and prairie dogs remain. Large numbers of doves and songbirds and a few small animals and predators still inhabit the county. Grainfields and playa lakes attract large numbers of ducks and geese during fall and winter. Pheasant are on the increase, largely because of special efforts of farmers, ranchers, and the Hale County Soil and Water Conservation District. Careful management is required for most of the species, mainly because of the lack of food and cover during winter when crops are off the land.

Two wildlife sites are recognized in Hale County—the Mixedland-Hardland site and the Sandyland site. These sites are related specifically to the soil associations, which are shown on the General Soil Map in the back of this survey. They differ in topography, in kinds and amounts of vegetation, and in management requirements for wildlife.

The Mixedland-Hardland site covers most of the county. It consists of the Pullman-Olton association, the Pullman association, the Olton-Amarillo-Acuff association, and the Mansker-Bippus-Berda association. The topography is nearly level to sloping. Most of the area is cultivated. A few small areas are in native rangeland. The dominant species of vegetation are buffalograss, blue grama, and side-oats grama. A few trees, such as Chinese elm, have been planted around farmsteads. Year-round food and cover is a concern on this site, and good management for wildlife requires food and cover plantings. These plantings should be left during winter and protected from grazing. Playa lakes are used by ducks and geese in fall when they contain water. The more important game species are pheasant, ducks, geese, doves, and quail. Other wildlife species in limited numbers are prairie dogs, rabbits, coyotes, and songbirds.

The Sandyland site consists of the Brownfield-Tivoli association. The topography is nearly level to steep. Most of the area is in native rangeland. A few of the smoother areas are cultivated. The dominant species of vegetation are little bluestem, sand bluestem, switchgrass, side-oats grama, dropseed, and sand sagebrush. Under good management and where protected from overgrazing, this site provides good food and cover for wildlife. The dominant species are pheasant, quail, and doves. Other species are coyotes, rabbits, and songbirds.

Engineering Uses of the Soils [3]

This section provides information of special interest to engineers, contractors, farmers, and others who deal with soils as structural material or as foundation material upon which structures are built. It is concerned with those properties of the soils that affect the construction and maintenance of roads and airports, pipelines, building foundations, water storage facilities, erosion control structures, drainage systems, and sewage disposal systems. Among the soil properties most important in engineering are permeability, shear strength, compressibility, shrink-swell potential, water-holding capacity, grain-size distribution, plasticity, and reaction.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, farm ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

[3] By Y. E. McAdams, area engineer, Soil Conservation Service, Lubbock, Texas.

7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 3, 4, and 5. This information, along with the soil map and other parts of this survey, can be used to make interpretations in addition to those given in the tables.

This information does not eliminate the need for further investigation at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables. Even in these situations, however, the soil map is useful in planning more detailed field investigations and for indicating the kinds of problems that can be expected. Also, the inspection of sites is needed because many delineated areas of a given soil contain small areas of other soils that have strongly contrasting properties and different suitabilities or limitations for engineering.

No specific values should be inferred from the verbal estimates of traffic-supporting capacity.

Some of the terms used in this soil survey have different meanings in soil science than they have in engineering. The Glossary defines many of these terms as they are commonly used in soil science.

Engineering classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*8*), used by the engineers of the Soil Conservation Service, the Department of Defense, and others, and the AASHO system (*1*), adopted by the American Association of State Highway Officials. An estimate of the classification of each soil in Hale County according to each of these two systems is given in table 3.

In the Unified system, soils are classified according to particle-size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-gained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes, for example, ML–CL.

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade.

Estimated engineering properties

Table 3 gives estimates of several of the soil properties that are significant in engineering. The estimates are based on field classification and descriptions of the soils, on experience in working with the soils, and on physical and chemical test data for comparable soils in adjacent areas. No laboratory tests have been made to determine the engineering properties of the soils of Hale County.

Table 3 does not show the depth to bedrock or depth to the water table, because these depths are many feet below the surface in all the soils in the county.

Brief explanations of the columns in table 3 are given in the following paragraphs.

Hydrologic soil groups give the runoff potential from rainfall. Four major soil groups are used. The soils are classified on the basis of intake of water at the end of a long-duration storm, after prior wetting and opportunity for swelling and without the protective effects of vegetation. Group A consists chiefly of deep, well-drained to excessively drained sands or gravels. These soils have a high rate of water transmission in that water readily passes through them. They have a high infiltration rate even when thoroughly wet and have low runoff potential. Group B consists chiefly of moderately deep to deep, moderately well drained to well drained soils that have moderately fine texture to moderately coarse texture. They have a moderate infiltration rate when thoroughly wet. Group C consists chiefly of soils that have a layer that impedes downward movement of water or soils that have moderately fine to fine texture. These soils have a slow rate of water transmission. They have a slow infiltration rate when thoroughly wet. Group D consists chiefly of clay soils that have a high swelling potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and shallow soils underlain by nearly impervious material. These soils have a very slow rate of water transmission. They have a very slow infiltration rate when throughly wet and have high runoff potential.

Soil texture is described in table 3 in the standard terms used by the U. S. Department of Agriculture.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 3 do not take into account lateral seepage or such transient soil expressed as a pH value.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed as a pH value.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content; that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. The extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Interpretations of engineering properties

Tables 4 and 5 contain selected interpretations useful to engineers and others who plan to use soil material in construction of highways, farm and ranch facilities, light industrial facilities, and sewage disposal systems.

The ratings, degrees of limitation, and other interpretations in these tables are based on estimated engineering properties of the soils (see table 3), on available test data from nearby counties, and on field experience.

Table 4 gives interpretations for the farm and ranch uses described in the following paragraphs.

Farm pond reservoir areas are areas behind a dam or embankment where water is collected and stored for use. The floor of the reservoir area is normally undisturbed except where soil material is borrowed for embankment construction. Construction material for embankments is rated separately.

Farm pond embankments are raised structures of soil material constructed across drainageways to impound water. These embankments are generally less than 20 feet high, are constructed of homogeneous soil material, and are compacted to medium density. The embankment foundation, reservoir area, and slope are assumed to be suitable for pond construction.

Irrigation is affected by soil features such as slope, permeability, thickness of the soil, and potential flood hazards that might wash out irrigation borders.

Terraces and diversions are affected by soil features such as cracking, thickness of the soil, and slope. These structures are not ordinarily used on some soils.

Grassed waterways are natural or man-shaped watercourses, covered with a close-growing grass, that are used to carry off excess water from the terrace system. Soil features affecting waterways include cracking, water-holding capacity, and soil structure, because of their effects on growth, soil thickness, and slope and erodibility.

Table 5 gives interpretations pertaining to highways, light industrial facilities, and recreational uses. The uses are described in the following paragraphs.

Topsoil is the soil material used to cover or resurface an area where vegetation is to be established and maintained. Properties considered are those that affect the productivity and workability of the soil material. These include texture, thickness of suitable material, organic matter, and presence of coarse fragments.

Road subgrade is the soil material on which a subbase is laid and the pavement is built. Suitability ratings are based on the performance of the soil material as subgrade when it is excavated and compacted or is compacted and used in place. Proper compaction and drainage of the subgrade material are assumed.

Highway location is influenced by features of the undisturbed soil that affect construction and maintenance of highways. The soil features favorable as well as unfavorable are the principal ones that affect geographic location of highways.

Light industries are rated for undisturbed soil that is used to support foundations for light industrial buildings no more than three stories high or foundation loads not in excess of that weight. Emphasis is on foundations, ease of excavation for underground utilities, and corrosion potential of uncoated steel pipe.

Septic tank filter fields are the subsurface tile systems that distribute effluent from a septic tank into the natural soil. The tile system is laid at least 18 inches deep. It is assumed that the septic tank disposal system is adequately designed and properly constructed. Soil properties of particular importance are permeability, presence of a water table, and susceptibility to flooding.

A sewage lagoon is a shallow pond constructed to hold sewage within a depth of 2 to 5 feet for the time required for the decomposition of solids. The lagoon consists of a nearly level floor and an embankment or dike that forms the side of the pond. The floor is generally undisturbed except where soil material has been borrowed for embankment construction. It is assumed that the embankment is compacted to medium density and the pond is protected from flooding.

Camp areas or campgrounds for overnight or weeklong camping need to be on soils that do not require hard surfacing for parking and that have no hard layers to interfere with setting tent pegs. The load-bearing strength of the natural soil, as influenced by soil texture and soil moisture, is a particularly important criterion in this rating. Flooding, dust or muddiness, slope, and stoniness are other criteria used in rating the soils for camp areas. Grass-covered, tree-shaded grounds are most desirable for campsites.

Picnic areas are defined as tree-shaded, park-type areas, complete with tables and cooking grills and readily accessible by automobile. It is assumed that vehicular traffic is confined to access roads. Flooding, slope, texture of the surface layer, and amount of coarse fragments on the surface are considered in making the evaluation.

Playgrounds are natural soil areas that are to be used intensively as playing grounds for sports, such as baseball, football, volleyball, soccer, and other similar organized games. These areas are subject to intensive foot traffic. They should be nearly level, have good drainage, and have a firm surface that is free of rock outcrops and stones.

Paths and trails are defined as footpaths, hiking trails, or bridlepaths along which the seeker of recreation has the opportunity to enjoy the beauty of nature. It is assumed that only enough natural vegetation is removed to provide a pathway, and that there are few if any excavations or fill areas along the pathway. Because a grass cover cannot be maintained in the pathway, muddiness and dustiness are particularly important soil features considered in the ratings. Also considered are whether the surface is stony or gravelly, steepness of slopes, hazard of flooding, and need to design and maintain these trafficways to minimize erosion.

Corrosivity, as used in table 5, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel. The rate of corrosion is related to soil properties such as drainage, texture, total acidity, and electrical conductivity of the soil material. Installations that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon.

Foundations for low buildings were not included in table 5, because most of the soils of Hale County are rated slight. Exceptions are Olton soils that are rated moderate and Lofton, Pullman, and Randall soils that are rated severe.

The corrosivity of concrete was not included, because all the soils in Hale County are rated low.

Sand and gravel were not included, because most of the soils of Hale County are not good sources. Brownfield and Tivoli soils are sources of sand in places.

TABLE 3.—*Estimated*

[The symbol >

Soil series and map symbols	Hydrologic group	Depth from surface	Classification		
			USDA texture	Unified	AASHO
		Inches			
Acuff: AcA, AcB	B	0–12	Loam	CL, ML–CL	A–4, A–6
		12–42	Sandy clay loam	CL	A–6
		42–80	Sandy clay loam	CL	A–6
Amarillo: AlB, AmA, AmB, AmC	B	0–8	Fine sandy loam	SM, SM–SC	A–4, A–2
		8–38	Sandy clay loam	SM–SC, CL	A–6
		38–80	Sandy clay loam	SC, CL	A–6
Arch: ArB	B	0–14	Loam	CL	A–4 or A–6
		14–60	Clay loam	CL	A–6
Berda: BeC, BeD	B	0–7	Loam	CL	A–4, A–6
		7–60	Sandy clay loam	SC, CL	A–4, A–6
Bippus: BfA, BfB, BpA, BpB	B	0–60	Loam or clay loam	SM–SC, SC, CL	A–4 or A–6
Brownfield: Br	A	0–26	Fine sand	SP–SM, SM	A–2–4
		26–90	Sandy clay loam or fine sandy loam	SC, SM–SC	A–2–4, A–2–6, A–6
Drake: DrB, DsD	B	0–50	Sandy clay loam	ML–CL, CL, ML	A–6, A–4
Estacado: EsA, EsB	B	0–16	Loam	ML, CL	A–6
		16–28	Clay loam	ML, CL	A–6, A–7–6
		28–80	Clay loam	ML, CL	A–6, A–7–6
Lofton: Lo	D	0–9	Clay loam	CL	A–6, A–7–6
		9–50	Clay	CL or CH	A–7–6
		50–72	Clay loam	CL	A–6, A–7–6
Mansker: MkB, MkC	B	0–6	Loam	ML, CL, SM, SC	A–4, A–6
		6–28	Clay loam	ML, CL, SC	A–4, A–6
		28–60	Clay loam	ML, CL	A–6
Midessa: MsA, MsB	B	0–12	Fine sandy loam	SM, ML, ML–CL	A–4, A–2–4
		12–30	Sandy clay loam	SC, CL	A–6
		30–76	Sandy clay loam	SC, CL	A–6
Olton: OtA, OtB	C	0–14	Loam	ML, CL	A–6, A–4
		14–42	Clay loam	CL	A–6, A–7
		42–72	Clay loam	ML–CL, CL	A–6, A–4
Posey: PoB, PoC	B	0–10	Fine sandy loam	SM	A–2–4
		10–72	Sandy clay loam	SC, ML, CL, ML–CL	A–6, A–4
Potter: Pt	C	0–8	Gravelly loam	ML, CL	A–4, A–6
		8–60	Loam and sandy clay loam (caliche).[1]		

engineering properties

means more than]

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
				Inches per hour	*Inches per inch of soil*	*pH value*	
	100	95–100	50–65	0. 63–2. 0	0. 14–0. 17	7. 4–7. 8	Low.
	100	95–100	65–75	0. 63–2. 0	0. 15–0. 18	7. 4–8. 4	Low.
95–100	90–100	90–95	60–70	0. 63–2. 0	0. 12–0. 15	7. 9–8. 4	Low.
	100	95–100	20–50	2. 0–6. 3	0. 11–0. 14	6. 6–7. 3	Low.
	100	95–100	40–65	0. 63–2. 0	0. 15–0. 17	7. 4–7. 8	Low.
90–100	90–99	80–90	35–60	0. 63–2. 0	0. 11–0. 13	7. 9–8. 4	Low.
100	100	90–100	50–75	0. 63–2. 0	0. 12–0. 15	7. 9–8. 4	Low.
100	100	90–100	60–80	0. 63–2. 0	0. 10–0. 14	7. 9–8. 4	Low.
95–100	95–100	80–95	50–60	0. 63–2. 0	0. 14–0. 16	7. 9–8. 4	Low.
95–100	95–100	80–95	40–60	0. 63–2. 0	0. 14–0. 17	7. 9–8. 4	Low.
100	95–100	85–100	35–70	0. 63–2. 0	0. 16–0. 20	7. 9–8. 4	Low.
100	100	95–100	5–20	6. 3–20. 0	0. 05–0. 08	6. 6–7. 3	Low.
100	100	95–100	25–45	0. 63–2. 0	0. 13–0. 16	6. 6–7. 8	Low.
100	100	75–90	50–65	0. 63–2. 0	0. 10–0. 14	7. 9–8. 4	Low.
100	98–100	95–100	50–70	0. 63–2. 0	0. 14–0. 18	7. 9–8. 4	Low.
95–100	95–100	85–100	55–90	0. 63–2. 0	0. 12–0. 16	7. 9–8. 4	Low.
95–100	95–100	95–100	60–95	0. 63–2. 0	0. 13–0. 17	7. 9–8. 4	Low.
100	100	98–100	70–85	0. 20–0. 63	0. 16–0. 19	7. 4–7. 8	Moderate.
100	100	95–100	75–90	>0. 06	0. 16–0. 18	7. 9–8. 4	High.
100	95–100	90–100	70–80	0. 06–0. 20	0. 14–0. 16	7. 9–8. 4	Moderate.
95–100	95–100	80–95	40–70	0. 63–2. 0	0. 14–0. 18	7. 9–8. 4	Low.
95–100	90–100	85–95	40–75	0. 63–2. 0	0. 13–0. 16	7. 9–8. 4	Low.
100	95–100	90–98	50–80	0. 63–2. 0	0. 14–0. 18	7. 9–8. 4	Low.
95–100	95–100	85–95	35–55	2. 0–6. 3	0. 12–0. 14	7. 9–8. 4	Low.
95–100	95–100	90–100	40–55	0. 63–2. 0	0. 13–0. 16	7. 9–8. 4	Low.
90–100	80–95	80–95	40–55	0. 63–2. 0	0. 11–0. 12	7. 9–8. 4	Low.
100	95–100	85–95	65–75	0. 63–2. 0	0. 16–0. 19	7. 4–7. 8	Low.
100	90–100	90–100	70–80	0. 20–0. 63	0. 16–0. 19	7. 4–8. 4	Moderate.
90–100	90–100	90–100	65–75	0. 63–2. 0	0. 10–0. 15	7. 9–8. 4	Low.
100	100	90–100	25–35	2. 0–6. 3	0. 10–0. 15	7. 9–8. 4	Low.
85–100	85–100	85–90	45–80	0. 63–2. 0	0. 10–0. 15	7. 9–8. 4	Low.
80–95	75–90	70–85	50–65	0. 63–2. 0	0. 12–0. 15	7. 9–8. 4	Low.

TABLE 3.—*Estimated*

Soil series and map symbols	Hydrologic group	Depth from surface	Classification		
			USDA texture	Unified	AASHO
		Inches			
Pullman: PuA, PuB	D	0–10	Clay loam	CL	A–6, A–7–6
		10–46	Clay	CL, CH	A–7–6
		46–84	Clay loam	CL	A–6, A–7–6
Randall: Ra	D	0–66	Clay	CH, CL	A–7–6, A–6
Springer: SpB	B	0–12	Loamy fine sand	SM, SP–SM	A–2–4, A–3
		12–50	Fine sandy loam	SM, SM–SC	A–2–4
		50–65	Loamy fine sand	SM, SP–SM	A–3, A–2–3
		65–84	Sandy clay loam	SM, SM–SC	A–2–4, A–4
Tivoli: Tv	A	0–60	Fine sand	SP–SM	A–3, A–2
Zita: ZmA, ZmB	B	0–12	Loam	CL	A–6, A–4
		12–32	Clay loam	CL	A–6, A–7–6
		32–72	Clay loam	CL	A–6

[1] Too variable to rate.

engineering properties—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
				Inches per hour	*Inches per inch of soil*	*pH value*	
100	100	95–100	70–85	0. 20–0. 63	0. 15–0. 18	7. 4–7. 8	Moderate.
100	100	95–100	70–85	>0. 06	0. 12–0. 16	7. 4–8. 4	High.
95–100	90–100	90–100	80–95	0. 06–0. 20	0. 12–0. 16	7. 9–8. 4	Moderate.
100	100	96–100	60–98	>0. 06	0. 14–0. 18	6. 6–8. 4	High.
100	95–100	70–85	8–25	6. 3–20. 0	0. 08–0. 10	6. 6–7. 3	Low.
100	95–100	80–95	11–35	2. 0–6. 3	0. 11–0. 14	7. 4–7. 8	Low.
100	95–100	70–85	8–25	6. 3–20. 0	0. 06–0. 10	7. 4–7. 8	Low.
100	95–100	80–95	30–50	2. 0–6. 3	0. 09–0. 14	7. 4–7. 8	Low.
100	100	65–95	5–12	6. 3–20. 0	0. 05–0. 08	6. 6–8. 4	Low.
100	100	98–100	55–60	0. 63–2. 0	0. 15–0. 19	7. 9–8. 4	Low.
98–100	98–100	95–99	60–70	0. 63–2. 0	0. 15–0. 20	7. 9–8. 4	Low.
90–100	80–90	75–85	50–70	0. 63–2. 0	0. 12–0. 16	7. 9–8. 4	Low.

TABLE 4.—*Engineering interpretations for farm and ranch uses*

Soil series and map symbols	Limitations for farm ponds		Soil features affecting—		
	Reservoir areas	Embankments	Irrigation	Terraces and diversions	Grassed waterways
Acuff: AcA, AcB	Moderate: moderate permeability.	Moderate: fair to good resistance to piping and erosion.	All features favorable.	All features favorable.	All features favorable.
Amarillo: AlB, AmA, AmB, AmC.	Moderate: moderate permeability.	Moderate: fair resistance to piping; moderate permeability.	Erosion hazard	All features favorable.	Erosion hazard.
Arch: ArB	Severe: calcareous material; seepage.	Moderate: poor resistance to piping; moderate permeability.	Shallow to moderately deep to calcareous material.	Erosion hazard	Erosion hazard.
Berda: BeC, BeD	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Sloping	Sloping	Sloping.
Bippus: BfA, BfB, BpA, BpB.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	All features favorable.	All features favorable.	All features favorable.
Brownfield: Br	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Erosion hazard; high intake rate.	Erosion hazard	Erosion hazard.
Drake: DrB, DsD	Severe: highly calcareous material; seepage.	Moderate: fair resistance to piping and erosion.	Erosion hazard; slopes.	Erosion hazard; slopes.	Erosion hazard; slopes.
Estacado: EsA, EsB	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Layer high in lime at depth of 8 to 18 inches.	Layer high in lime at depth of 8 to 18 inches.	Layer high in lime at depth of 8 to 18 inches.
Lofton: Lo	Slight	Moderate: fair resistance to piping and erosion.	Low intake rate	All features favorable.	All features favorable.
Mansker: MkB, MkC	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Layer high in lime at depth of 10 to 15 inches.	Layer high in lime at depth of 10 to 15 inches.	Layer high in lime at depth of 10 to 15 inches.
Midessa: MsA, MsB	Severe: seepage	Moderate: fair resistance to piping and erosion.	All features favorable.	Moderately deep to layer high in lime.	Erosion hazard.

TABLE 4.—*Engineering interpretations for farm and ranch uses*—Continued

Soil series and map symbols	Limitations for farm ponds		Soil features affecting—		
	Reservoir areas	Embankments	Irrigation	Terraces and diversions	Grassed waterways
Olton: OtA, OtB	Moderate: moderately slow permeability.	Moderate: fair resistance to piping and erosion.	All features favorable.	All features favorable.	All features favorable.
Posey: PoB, PoC	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion; fair stability.	All features favorable.	Shallow to moderately deep to layer high in lime.	Erosion hazard; calcareous; slopes.
Potter: Pt	Severe: seepage	Severe: 4 to 12 inches of material.	Layer high in lime at depth of 4 to 12 inches.	Layer high in lime at depth of 4 to 12 inches.	Layer high in lime at depth of 4 to 12 inches.
Pullman: PuA, PuB	Slight	Moderate: fair resistance to piping and erosion.	Low intake rate	All features favorable.	All features favorable.
Randall: Ra	Slight	Moderate: high compressibility; fair slope stability.	Very low intake rate; somewhat poorly drained.	Somewhat poorly drained.	Somewhat poorly drained.
Springer: SpB	Severe: moderately rapid permeability.	Severe: fair resistance to piping and erosion.	Erosion hazard; moderately rapid permeability.	Erosion hazard	Erosion hazard.
Tivoli: Tv	Severe: rapid permeability.	Severe: poor resistance to piping and erosion; poor slope stability.	Erosion hazard; rapid permeability.	Erosion hazard	Erosion hazard.
Zita: ZmA, ZmB	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	All features favorable.	All features favorable.	All features favorable.

TABLE 5.—*Interpretations for highways,*

Soil series and map symbols	Suitability as source of—		Limitations for highways and buildings		
	Topsoil	Road subgrade	Highway location	Light industry	Septic tank filter fields
Acuff: AcA, AcB	Fair: 10 to 14 inches of loam.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Moderate: moderate corrosivity.	Slight
Amarillo: AlB, AmA, AmB, AmC.	AlB—poor: loamy fine sand texture. AmA, AmB, AmC—fair: 7 to 16 inches of fine sandy loam.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Moderate: moderate corrosivity.	Slight
Arch: ArB	Fair: 7 to 14 inches of loam.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Severe: high corrosivity.	Slight
Berda: BeC, BeD	Fair: 7 to 15 inches of loam.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Moderate: moderate corrosivity.	Slight: 3 to 5 percent slopes. Moderate: 5 to 8 percent slopes.
Bippus: BfA, BfB, BpA, BpB.	BfA, BfB—fair: 15 to 20 inches of loam or fine sandy loam. BpA, BpB—good: 20 to 30 inches of loam or fine sandy loam.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Moderate: moderate corrosivity.	Slight
Brownfield: Br	Poor: fine sand texture.	Good	Slight	Moderate: moderate corrosivity.	Slight
Drake: DrB, DsD	Fair: 8 to 18 inches of loam.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Severe: high corrosivity.	Slight: 0 to 5 percent slopes. Moderate: 5 to 8 percent slopes.
Estacado: EsA, EsB	Fair: 8 to 18 inches of loam.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Moderate: moderate corrosivity.	Slight
Lofton: Lo	Fair: clay loam texture.	Poor: high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: high shrink-swell potential; high corrosivity.	Severe: very slow permeability.
Mansker: MkB, MkC	Fair: 6 to 15 inches of loam.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Moderate: moderate corrosivity.	Slight

buildings, and recreational facilities

Limitations for highways and buildings—Continued	Limitations for recreational facilities				Corrosivity (uncoated steel)
Sewage lagoons	Camp areas	Picnic areas	Playgrounds	Paths and trails	
Moderate: moderate permeability.	Slight	Slight	Slight: 0 to 2 percent slopes. Moderate: 2 to 5 percent slopes.	Slight	Moderate: sandy clay loam texture.
Moderate: moderate permeability.	AlB—moderate: loamy fine sand texture. AmA, AmB, AmC—slight.	AlB—moderate: loamy fine sand texture. AmA, AmB, AmC—slight.	AlB—moderate: loamy fine sand texture. AmA, AmB, AmC—slight if slope is 0 to 2 percent; moderate where slope is 2 to 5 percent.	AlB—moderate: loamy fine sand texture. AmA, AmB, AmC—slight.	Moderate: sandy clay loam texture.
Severe: calcareous material; seepage.	Slight	Slight	Slight	Slight	High: conductivity.
Moderate: moderate permeability.	Slight	Slight	Moderate: 3 to 6 percent slopes. Severe: 6 to 8 percent slopes.	Slight	Moderate: sandy clay loam texture.
Moderate: moderate permeability.	Slight	Slight	Slight: 0 to 2 percent slopes. Moderate: 2 to 3 percent slopes.	Slight	Moderate: clay loam texture.
Moderate: moderate permeability.	Severe: fine sand texture.	Severe: fine sand texture.	Severe: fine sand texture.	Severe: fine sand texture.	Moderate: sandy clay loam subsoil.
Severe: highly calcareous material; seepage.	Moderate: dust	Moderate: dust	Moderate: dust; 2 to 5 percent slopes. Severe: 6 to 8 percent slopes.	Moderate: dust	High: conductivity.
Moderate: moderate permeability.	Slight	Slight	Slight: 0 to 2 percent slopes. Moderate: 2 to 3 percent slopes.	Slight	Moderate: clay loam texture.
Slight	Severe: very slow permeability.	Moderate: clay loam texture.	Severe: very slow permeability.	Moderate: clay loam texture.	High: clay subsoil.
Moderate: moderate permeability.	Slight	Slight	Slight: 0 to 2 percent slopes. Moderate: 2 to 3 percent slopes.	Slight	Moderate: clay loam texture.

TABLE 5.—*Interpretations for highways, buildings,*

Soil series and map symbols	Suitability as source of—		Limitations for highways and buildings		
	Topsoil	Road subgrade	Highway location	Light industry	Septic tank filter fields
Midessa: MsA, MsB	Fair: 10 to 20 inches of fine sandy loam.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Severe: high corrosivity.	Slight
Olton: OtA, OtB	Fair: 6 to 14 inches of loam.	Fair: fair traffic-supporting capacity; moderate shrink-swell potential.	Moderate: fair traffic-supporting capacity; moderate shrink-swell potential.	Moderate: moderate corrosivity.	Moderate: moderately slow permeability.
Posey: PoB, PoC	Fair: 5 to 15 inches of fine sandy loam.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Moderate: moderate corrosivity.	Slight
Potter: Pt	Poor: 10 to 15 percent coarse fragments.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Severe: high corrosivity.	Moderate: moderate permeability.
Pullman: PuA, PuB	Fair: clay loam texture.	Poor: high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: high corrosivity; high shrink-swell potential.	Severe: very slow permeability.
Randall: Ra	Poor: clay texture.	Poor: high shrink-swell potential.	Severe: high shrink-swell potential; flood hazard.	Severe: high corrosivity; flood hazard; high shrink-swell potential; somewhat poorly drained.	Severe: very slow permeability.
Springer: SpB	Poor: loamy fine sand texture.	Good	Slight	Slight	Slight
Tivoli: Tv	Poor: fine sand texture.	Good	Slight	Slight	Slight
Zita: ZmA, ZmB	Fair: 10 to 20 inches of loam.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Moderate: moderate corrosivity.	Slight

and recreational facilities—Continued

Limitations for highways and buildings—Continued	Limitations for recreational facilities				Corrosivity (uncoated steel)
Sewage lagoons	Camp areas	Picnic areas	Playgrounds	Paths and trails	
Severe: seepage	Slight	Slight	Slight: 0 to 2 percent slopes. Moderate: 2 to 3 percent slopes.	Slight	High: high conductivity.
Slight: 0 to 2 percent slopes. Moderate: 2 to 3 percent slopes.	Moderate: moderately slow permeability.	Slight	Moderate: moderately slow permeability.	Slight	Moderate: clay loam texture.
Moderate: moderate permeability.	Slight	Slight	Slight: 0 to 2 percent slopes. Moderate: 2 to 5 percent slopes.	Slight	Moderate: sandy clay loam texture.
Severe: seepage	Slight	Slight	Slight: 0 to 2 percent slopes. Moderate: 2 to 6 percent slopes. Severe: 6 to 7 percent slopes.	Slight	High: conductivity.
Slight	Moderate: clay loam texture; very slow permeability.	Moderate: clay loam texture.	Moderate: clay loam texture; very slow permeability.	Moderate: clay loam texture.	High: clay texture.
Slight	Severe: clay texture; somewhat poorly drained.	Severe: clay texture; somewhat poorly drained.	Severe: clay texture; very slow permeability; somewhat poorly drained; flood hazard.	Severe: clay texture; somewhat poorly drained.	High: clay texture; somewhat poorly drained.
Severe: moderately rapid permeability.	Moderate: loamy fine sand texture.	Moderate: loamy fine sand texture.	Moderate: loamy fine sand texture.	Moderate: loamy fine sand texture.	Low.
Severe: rapid permeability.	Severe: fine sand texture; 15 to 35 percent slopes.	Severe: fine sand texture; 15 to 35 percent slopes.	Severe: fine sand texture; 6 to 35 percent slopes.	Severe: fine sand texture; 25 to 35 percent slopes.	Low.
Moderate: moderate permeability.	Slight	Slight	Slight: 0 to 2 percent slopes. Moderate: 2 to 3 percent slopes.	Slight	Moderate: clay loam texture.

Drainage was not included, because drainage is not a problem on most soils of the county. Randall soils are in depressional areas and are somewhat poorly drained.

Formation and Classification of the Soils

This section discusses the major factors of soil formation as they have existed in Hale County and provides the classification of the soils of the county according to the system currently used by the National Cooperative Soil Survey.

Factors of Soil Formation

The characteristics of the soil at any given place are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil development have acted on the soil material.

Climate and vegetation are the active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and bring about the development of genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme instances, determines it almost entirely. Finally, time is needed for the changing of the parent material into a soil profile. Generally, a long time is required for the development of distinct horizons.

Climate

The climate is uniform throughout the county, but its effects have been modified locally by relief and runoff. In some of the soils, carbonates have been leached from the surface layer. In other soils, there is free lime throughout the solum. In most of the soils there is a lime-enriched layer at a depth of 1 to 5 feet.

Climate has affected the formation of some of the soils through the action of winds. High winds, especially during dust storms, are continually moving calcium carbonate and recharging the soils with lime.

Although the soils in Hale County formed under prairie vegetation, the warm temperature restricted the accumulation of organic matter in most of them. Oxidation processes burned up most of the organic matter as it was being added to the soil through the decay of plant residue and roots. The sandy soils, such as Brownfield and Tivoli soils, are low in organic-matter content. The soils highest in organic-matter content include Bippus, Pullman, and Lofton soils.

Living organisms

Plants, animals, earthworms, and micro-organisms have contributed to the formation of the soils. Earthworms are the most obvious form of animal life in most soils. Activity has been greatest in calcareous, friable soils. Soils that have a compact, clayey subsoil, such as those of the Pullman series, show very little earthworm activity. Worm casts add to the fertility of soils and facilitate the movement of air, water, and plant roots through the soil profile.

Small animals, such as prairie dogs, have played a part in soil formation. By their burrowing, these animals have mixed and churned the soil material, and this mixing has offset the effects of leaching of carbonates. Krotovinas 4 to 18 inches in diameter are common in the lower part of the subsoil of most of the soils.

Although the soils in Hale County formed under mixed prairie vegetation and large amounts of organic matter were added, the warm temperature prevented the accumulation of organic matter to high levels. The surface layer, however, is very friable in most soils and has a granular structure. The many root channels left in the subsoil have improved the permeability and aeration of all the soils.

Parent material

Parent material probably has had more influence on the kinds of soil that formed in the county than any other factor. The kind of soil that formed at any given place seemingly depends mainly on the kind of parent material at the surface.

Many of the soils formed in the thick, fairly uniform eolian mantle that blankets the county. This mantle was deposited over the southern High Plains during the Pleistocene age, and it is commonly referred to as cover sands (*3*, *4*). The eolian material moved in from the southwest during dry periods and periods of high wind. The eolian mantle is 10 to 40 feet thick in most places and shows good structure and soil development throughout. The material is mostly sandy clay loam, clay loam, and clay interbedded with layers of soft, pinkish-white caliche. In the southwestern part of the county, where the material is more sandy, the Amarillo and Acuff soils formed. To the east and north, where the material becomes less sandy and more clayey, the Olton, Lofton, and Pullman soils formed. In areas that are higher in content of caliche, or where caliche layers are closer to the surface, the Estacado, Mansker, and Posey soils formed.

The material that occurs along the draws and in playas is more recent in age. The Bippus soils formed in the loamy sediment on the valley floors along draws. The Berda soils formed in a thin mantle of calcareous, loamy colluvium on the lower slopes that parallel the draws. The Randall soils formed on the bottom of the playas where the material is clayey. The Estacado, Zita, and Lofton soils formed on the benches around the playas where the material is more loamy. The Drake soils formed in windblown material on the east and south sides of some playas where there is a ridge of loamy, highly calcareous material that has recently blown from the lake basins.

In the extreme western part of the county, there is a small area of sandhills that connects to larger areas in adjoining counties. This small area consists of a thin mantle of sandy material in which the Tivoli, Brownfield, and Springer soils formed.

Immediately below the eolian mantle on the High Plains is the Ogallala formation. This formation is of

Pliocene age and consists of calcareous, fluvatile material made up of sand, gravel, and loamy sediments, and in some places the upper part is capped with caliche. This material ranges from 25 to 300 feet in thickness. The Potter soils formed in this exposed caliche material.

Topography

Topography, or relief, influences the formation of soils through its effect on drainage, runoff, and erosion. The topography of Hale County is generally nearly level to gently sloping. A few areas are steeper around some of the deep playa lakes, on sand dunes, and along the streams. If other factors of soil formation are equal, the degree of profile development depends largely on the moisture that enters and passes through the soil. Steep soils absorb less moisture and are more susceptible to erosion. Therefore, they generally have a thinner, less developed profile.

Soils that are nearly level, such as Pullman, Olton, and Amarillo soils, are well developed; relief has not been a limiting factor. In contrast, the Potter soils have been strongly influenced by relief. These soils are gently sloping to sloping, and runoff and geologic erosion have been high.

Soils in low, concave positions show the influence of relief upon their development. The Lofton, Bippus, and Zita soils are much darker in color and higher in organic-matter content. This is the result of having extra water that helps to produce more vegetation in these low areas. Soils in poorly drained areas, such as Randall clay in the playas, show the influence that excess water has on soil development.

Time

Generally a long time is required for the formation of soils. The difference in length of time that the soil material has been in place, therefore, is commonly reflected in the degree of development of the soil profile.

The older soils in Hale County that are well developed include those of the Pullman, Olton, and Amarillo series. These soils have distinct, well-expressed horizons, and silicate clay has moved out of the surface layer and into the lower layers. Soils that are intermediate in development are Zita, Bippus, and Berda soils. These soils have weak horizon development, but no silicate clay has accumulated in the B horizon. Drake soils have been in place for a short time, and the soil horizons have only begun to form. Most of the development is in the surface layer, where there is some accumulation of organic matter and an alteration of parent materials by vegetation, earthworms, and micro-organisms.

Classification of the Soils

Classification consists of an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships. Classification is useful in organizing and applying the results of experience and research.

Soils are placed in narrow classes for discussion in detailed soil surveys and for application of knowledge within farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories, so that information can be applied to large geographic areas.

The current system of classification defines classes in terms of observable or measurable properties of soils. The properties chosen are primarily those that permit the grouping of soils that are similar in genesis, although genesis, or mode of soil origin, does not appear in the definitions of the classes. The classification is designed to accommodate all soils.

The system of soil classification discussed in this subsection is that adopted for general use by the National Cooperative Soil Survey in 1965 (*7*). It replaces the classification of Baldwin, Kellogg, and Thorp (*2*) as revised by Thorp and Smith (*5*). The current system has six categories. Beginning with the broadest and most inclusive, the categories are the order, the suborder, the great group, the subgroup, the family, and the series. The six categories are defined in the following paragraphs. Table 6 gives the family, subgroup,

TABLE 6.—*Classification of soil series*

Series	Family	Subgroup	Order
Acuff	Fine-loamy, mixed, thermic	Aridic Paleustolls	Mollisols.
Amarillo	Fine-loamy, mixed, thermic	Aridic Paleustalfs	Alfisols.
Arch	Fine-loamy, mixed, thermic	Ustochreptic Calciorthids	Aridisols.
Berda	Fine-loamy, mixed, thermic	Aridic Ustochrepts	Inceptisols.
Bippus	Fine-loamy, mixed, thermic	Cumulic Haplustolls	Mollisols.
Brownfield	Loamy, mixed, thermic	Arenic Aridic Paleustalfs	Alfisols.
Drake	Fine-loamy, mixed (calcareous), thermic	Typic Usthorthents	Entisols.
Estacado	Fine-loamy, mixed, thermic	Calciorthidic Paleustolls	Mollisols.
Lofton	Fine, mixed, thermic	Torrertic Argiustolls	Mollisols.
Mansker	Fine-loamy, carbonatic, thermic	Calciorthidic Paleustolls	Mollisols.
Midessa	Fine-loamy, mixed, thermic	Aridic Ustochrepts	Inceptisols.
Olton	Fine, mixed, thermic	Aridic Paleustolls	Mollisols.
Posey	Fine-loamy, mixed, thermic	Calciorthidic Paleustalfs	Alfisols.
Potter	Loamy, carbonatic, thermic, shallow	Ustollic Calciorthids	Aridisols.
Pullman	Fine, mixed, thermic	Torrertic Paleustolls	Mollisols.
Randall	Fine, montmorillonitic, thermic	Udic Pellusterts	Vertisols.
Springer	Coarse-loamy, mixed, thermic	Udic Paleustalfs	Alfisols.
Tivoli	Mixed, thermic	Typic Ustipsamments	Entisols.
Zita	Fine-loamy, mixed, thermic	Aridic Haplustolls	Mollisols.

and order for each series in the county. For some of the soils, the classification is still tentative and is subject to change.

ORDER: Soils are grouped into orders according to properties that seem to have resulted from the same processes acting to about the same degree on the parent material. Ten soil orders are recognized in the current system: Alfisols, Aridisols, Entisols, Histosols, Inceptisols, Mollisols, Oxisols, Spodosols, Ultisols, and Vertisols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. Two exceptions, Entisols and Histosols, occur in many different climates. Six of the ten soil orders are represented in Hale County: Alfisols, Aridisols, Entisols, Inceptisols, Mollisols, and Vertisols.

Alfisols are soils containing a clay-enriched B horizon that has high base saturation. This order is represented by soils of the Posey series.

Aridisols are primarily soils of dry places. They have a light-colored surface soil and free carbonates throughout their profile. This order is represented by soils of the Potter series.

Entisols are recent soils in which there has been little, if any, horizon development. This order is represented in this county by soils of the Drake and Tivoli series.

Inceptisols occur mostly on young, but not recent, land surfaces. This order is represented by soils of the Berda and Midessa series.

Mollisols are dark-colored soils that have a moderate to high content of organic matter and high base saturation. Some have a clay-enriched B horizon, and others have free carbonates throughout their profile. This order is represented by soils of the Acuff, Bippus, Estacado, Lofton, Mansker, and Pullman series.

Vertisols are soils in which natural churning or inversion of soil material takes place, mainly through the swelling and shrinking of clays. This order is represented by soils of the Randall series.

SUBORDER: Each order is divided into suborders, primarily on the basis of soil characteristics that indicate genetic similarity. The suborders have a narrower climatic range than the order. The criteria for suborders reflect either the presence or absence of waterlogging or soil differences resulting from climate or vegetation.

GREAT GROUP: Each suborder is divided into great groups on the basis of uniformity in kind and sequence of genetic horizons. The great group is not shown in table 6, because the name of the great group is the same as the last word in the name of the subgroup.

SUBGROUP: Each great group is divided into subgroups, one representing the central (typic) concept of the group, and other groups, called intergrades, that have properties of one great group but also one or more properties of another great group.

FAMILY: Families are established within subgroups, primarily on the basis of properties important to plant growth. Some of these properties are texture, mineralogy, reaction, soil temperature, permeability, consistence, and thickness of horizons.

SERIES: The series is a group of soils that have major horizons that, except for texture of the surface layer, are similar in important characteristics and in arrangement in the profile.

Climate [4]

Hale County has a dry steppe climate characterized by mild winters. Rains occur most frequently as the result of thunderstorms. The monthly and annual amounts of

[4] By ROBERT B. ORTON, climatologist for Texas, National Weather Service, U.S. Department of Commerce.

TABLE 7.—*Temperature and*

[Data recorded at Plainview, Texas; elevation 3,370 feet. Period of record,

Month	Temperature				Precipitation				
	Average daily maximum	Average monthly maximum	Average daily minimum	Average monthly minimum	Average total	Probability of receiving specified amounts during month			
						None or trace	0.5 inch or more	1 inch or more	2 inches or more
	°F.	°F.	°F.	°F.	In.	Pct.	Pct.	Pct.	Pct.
January	52.7	72	23.4	6	0.76	2	45	25	7
February	57.3	76	27.1	12	0.65	9	40	20	5
March	65.1	83	32.7	16	0.62	12	50	29	8
April	74.7	90	42.9	28	1.40	<1	70	47	19
May	82.4	96	52.3	39	3.04	<1	95	88	62
June	90.4	101	61.6	52	3.11	<1	90	75	52
July	92.6	100	65.2	59	2.67	1	90	70	45
August	91.7	100	63.7	57	1.86	2	80	65	40
September	85.0	96	56.8	45	1.97	3	79	60	35
October	76.0	90	45.9	33	1.62	4	80	80	35
November	63.6	81	33.0	19	2.55	20	39	20	6
December	55.5	73	26.7	12	0.76	8	47	28	9
Year	73.9	88	44.3	32	19.01				

[1] Average length of record, 12 years.
[2] Less than half a day.
[3] Trace; an amount too small to be measured.

rainfall are extremely variable. Annual extremes at Plainview have ranged from 9.28 inches in 1956 to 38.10 inches in 1926. The average annual precipitation is 19.01 inches. Approximately three-fourths of the average annual precipitation falls during the 6-month period of May through September. Prevailing winds are southerly to southwesterly throughout the year. Wind speed averages about 13.6 miles per hour. The average annual relative humidity is estimated at 74 percent at 6:00 a.m., 45 percent at noon, and 40 percent at 6:00 p.m. The seasonal variation is small. Hale County receives approximately 74 percent of the total possible sunshine annually. The average annual lake evaporation is 69 inches. Table 7 presents climatological data for the county, based on records kept at Plainview.

In winter, frequent surges of polar and arctic air masses bring rapid drops in temperature. Cold spells, however, are of short duration, rarely lasting longer than 48 hours before sunshine and westerly to southwesterly winds bring rapid warming. Freezes occur almost every night, but the daytime maximum temperature averages 55.2° F. Winter is a dry season. Precipitation commonly is in the form of light snow. The average monthly snowfall data are unduly biased by rare but exceptionally heavy snows, such as the ones that occurred in February 1956. From February 2 to February 5, 1956, 30 inches of snow fell at Plainview. The lowest temperature on record at Plainview is −8° F., which occurred on February 12, 1899 and again on January 3, 1911.

In spring the weather is very changeable. Through March and April, warm and cold spells follow each other in rapid succession. These are the windiest months of the year. Infrequently, strong, persistent southwesterly to northwesterly winds produce dust storms in the area. Thunderstorms, which rarely occur in winter, increase in number through spring and reach a peak in May and June. Rainfall is also heaviest during this period. A few of these thunderstorms that occur late in spring and early in summer are accompanied by damaging wind and hail.

Summer is one of the most moderate seasons on the High Plains. Rainfall and thunderstorm activity gradually decreases from June through August. Though afternoon temperatures are occasionally hot, most nights are pleasantly cool. The minimum temperature in summer averages 63.5° F.

Fall is also moderate, but there is greater variety in the weather as cold fronts push through the area. Rainfall increases slightly in September, but it decreases again in October. November is the driest month of the year. Mild, sunny days and crisp, cool nights characterize the fall season.

The warm season (freeze-free period) in Hale County averages 211 days. The average dates of the last occurrence of 32° F. in spring and the first occurrence of 32° F. in fall are April 10 and November 6, respectively. Low-temperature readings depend greatly on variations in topography, air drainage, and wind; therefore, significant departures from the average values are likely to be found within the county.

History and Settlement

Hale County was formed in 1876. It was named for John G. Hale, a First Lieutenant of the Infantry in the Army of General Sam Houston. He was killed in the battle of San Jacinto.

Cattle ranching was an early industry in the county. In those days ranches were owned by the Morrison brothers, C. C. Slaughter, and the Clement brothers.

precipitation data

1938–1967, unless otherwise indicated. The symbol < means less than]

Precipitation—Continued									
Probability of receiving specified amounts during month—Continued				Average number of days with—			Snow and sleet		
3 inches or more	4 inches or more	5 inches or more	6 inches or more	0.1 inch or more [1]	0.5 inch or more [1]	1 inch or more [1]	Average total	Monthly maximum	Greatest depth [1]
Pct.	*Pct.*	*Pct.*	*Pct.*				*In.*	*In.*	*In.*
2	<1	<1	<1	1	(2)	(2)	3.7	15.7	14
1	<1	<1	<1	2	(2)	(2)	3.8	31.8	30
3	1	<1	<1	2	(2)	(2)	1.6	13.0	5
8	4	1	<1	1	1	(2)	.3	3.0	7
42	30	20	12	4	1	1	(3)	(3)	0
34	20	11	10	6	3	2	0	0	0
20	10	5	1	4	2	1	0	0	0
20	10	5	5	3	1	(2)	0	0	0
22	12	10	5	4	1	1	0	0	0
21	11	7	3	3	1	(2)	(3)	(3)	0
2	1	<1	<1	1	(2)	(2)	.5	3.5	4
4	1	<1	<1	2	(2)	(2)	2.3	11.0	1
				34	10	5	12.2	31.8	30

Another early industry was the gathering of buffalo bones. The bones were shipped to eastern manufacturers and ground into fertilizer.

Farming began slowly in Hale County. In the late 1800's, small acreages were plowed and placed in cultivation. At first, grain sorghum was the main crop. The first wheat was grown about 1892 near Plainview, and the first flour mill was built in 1907. Cotton production started near Petersburg in 1900, and the county's first cotton gin was built in 1903.

In 1907 the first railroad came through the county. This speeded up the development of the county.

In 1910 the first irrigation well was drilled near Plainview, but it was not until the 1930's that irrigation became significant in the county. After this, irrigation began to have a big impact on the county. Irrigation reached a peak in the 1950's, but it is slowly decreasing because of a declining water table. Extensive irrigation has made Hale County one of the leading farming counties in the State. There are numerous manufacturing plants in the county.

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Glossary

Alluvium. Soil material that has been deposited on land by streams.

Available water capacity. The capacity of a soil to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at the wilting point. It is commonly expressed as inches of water per inch of soil.

Buried soil. A developed soil, once exposed but now overlain by a more recently formed soil.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in many soils of warm-temperature areas, as in the Southwestern States. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the solum or it may be exposed at the surface by erosion.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors, consisting of concentrations of compounds or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Contour farming. Plowing, cultivating, planting, and harvesting in rows that are at right angles to the natural direction of the slope or that are parallel to terrace grade.

Cover crop. A close-growing crop grown primarily to improve the soil and to protect it between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Diversion. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Dryfarming. Production of crops that require some tillage in a subhumid or semiarid region, without irrigation. Usually involves periods of fallow during which moisture can accumulate in the soil.

Dune. A mound or ridge of loose sand piled up by the wind.

Emergency tillage. Cultivation for the purpose of roughening the soil surface for temporary control of soil blowing.

Eolian soil material. Earthy parent material accumulated through wind action. Commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by wind, running water, and other geological agents.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors, such as light, moisture, temperature, and the physical condition of the soil are favorable.

Field moisture capacity. The moisture content of a soil expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has been allowed to drain away; the field moisture content 2 or 3 days after a soaking rain.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Forage. Plant material that can be used as feed by domestic animals; it may be grazed or cut for hay.

Friability. Term for the ease with which a soil crumbles. A friable soil is one that crumbles easily.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, covered by grass for protection against erosion; used to conduct surface water away from cropland.

Gravelly soil material. From 15 to 50 percent of material, by volume, consists of rounded or angular rock fragments that are not prominently flattened and are up to 3 inches in diameter.

Habitat. The natural abode of a plant or animal. It refers to the kind of environment in which a plant or animal normally lives, as opposed to its range, or geographical distribution.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes.

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residue.

A horizon.—The mineral horizon at the surface or just below the O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of the following: soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused by (1) accumulation of clay, sesquioxides, humus, or some combination of these; (2) prismatic or blocky structure; (3) redder or stronger colors than the A horizon; or (4) some combination or these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies the C horizon but may be immediately beneath the A or B horizon.

Intermittent stream. A stream or part of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long-continued supply from melting snow or other sources.

Irrigation. Application of water to soils to assist in production of crops.

Land leveling. The reshaping of the ground surface to make for a more uniform application of irrigation water.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Mulch. A natural or artificially applied layer of plant residue or other material on the surface of the soil; generally used to help conserve moisture, control temperature, prevent compaction or crusting, reduce runoff, control erosion, improve soil structure, or control weeds.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Natural soil drainage. Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A horizon and the upper part of the B horizon and have mottling in the lower part of the B horizon and the C horizon.

Somewhat poorly drained soils are wet for significant periods but not all the time. If podzolized, they commonly have mottling below a depth of 6 to 16 inches, in the lower part of the A horizon and in the B and C horizons.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Overgrazing. Grazing so heavy as to impair future forage production and to cause deterioration of plants, soil, or both.

Permanent pasture. Pasture that is maintained for a long time, in contrast to rotation pasture, which is maintained only a year or two at a time as part of a crop rotation.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *Very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

pH value. A numerical means for designating relatively weak acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Playa. The shallow central basin of a desert plain in which water collects after rain and stands until it evaporates.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Range (or rangeland). Land that, for the most part, produces native plants suitable for grazing by livestock; includes land in which there are some forest trees.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction. An acid, or "sour" soil is one that gives an acid reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher.

Relief. The elevations or inequalities of a land surface, considered collectively.

Sand. As a soil separate, rock or mineral fragments ranging from 0.05 to 2.0 millimeters in diameter. Most sand grains consist of quartz, but sand may be of any mineral composition. As a textural class, soil that is 85 percent or more sand and not more than 10 percent clay.

Silt. As a soil separate, mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief, over periods of time.

Soil separates. Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follow: *Very coarse sand* (2.0 to 1.0 millimeter); medium sand (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter; *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soils includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protection from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, or order of increasing proportions of fine particles, are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water.

Wilting point. The moisture content of a soil, on an oven-dry basis, at which plants (specifically sunflower) wilt so much that they do not recover when placed in a dark, humid atmosphere.

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GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read the descriptions of both the mapping unit and the series to which the mapping unit belongs. Management information for farming and ranching is included in the description of each mapping unit. Wildlife habitat management is discussed on page 35. Other information is given in tables as follows:

Acreage and extent, table 1, page 6.
Predicted yields, table 2, page 34.

Use of soils for engineering, tables 3, 4, and 5, pages 38 through 47.

Map symbol	Mapping unit	Described on page	Capability unit Dryland Symbol	Capability unit Irrigated Symbol	Range site Name
AcA	Acuff loam, 0 to 1 percent slopes	7	IIIe-4	IIe-1	Deep Hardland
AcB	Acuff loam, 1 to 3 percent slopes	8	IIIe-2	IIIe-2	Deep Hardland
AlB	Amarillo loamy fine sand, 0 to 3 percent slopes	9	IVe-5	IIIe-5	Sandyland
AmA	Amarillo fine sandy loam, 0 to 1 percent slopes	9	IIIe-3	IIe-2	Sandy Loam
AmB	Amarillo fine sandy loam, 1 to 3 percent slopes	9	IIIe-3	IIIe-3	Sandy Loam
AmC	Amarillo fine sandy loam, 3 to 5 percent slopes	10	IVe-3	IVe-1	Sandy Loam
ArB	Arch loam, 0 to 3 percent slopes	11	IVe-1	IIIe-4	High Lime
BeC	Berda loam, 3 to 5 percent slopes	12	IVe-6	IVe-3	Hardland Slopes
BeD	Berda loam, 5 to 8 percent slopes	12	VIe-2	------	Hardland Slopes
BfA	Bippus fine sandy loam, overwash, 0 to 1 percent slopes	13	IIIe-3	IIe-2	Sandy Loam
BfB	Bippus fine sandy loam, overwash, 1 to 3 percent slopes	13	IIIe-3	IIIe-3	Sandy Loam
BpA	Bippus loam, 0 to 1 percent slopes	13	IIe-1	IIe-1	Deep Hardland
BpB	Bippus loam, 1 to 3 percent slopes	14	IIIe-2	IIIe-2	Deep Hardland
Br	Brownfield fine sand	15	VIe-1	IVe-2	Deep Sand
DrB	Drake clay loam, 1 to 3 percent slopes	16	IVe-4	IIIe-3	High Lime
DsD	Drake soils, 3 to 8 percent slopes	16	VIe-3	IIIe-7	High Lime
EsA	Estacado loam, 0 to 1 percent slopes	17	IIIe-4	IIe-1	Hardland Slopes
EsB	Estacado loam, 1 to 3 percent slopes	18	IIIe-2	IIIe-2	Hardland Slopes
Lo	Lofton clay loam	18	IIIe-5	IIs-1	Deep Hardland
MkB	Mansker loam, 0 to 3 percent slopes	19	IVe-2	IIIe-6	Hardland Slopes
MkC	Mansker loam, 3 to 5 percent slopes	20	IVe-6	IVe-3	Hardland Slopes
MsA	Midessa fine sandy loam, 0 to 1 percent slopes	21	IIIe-3	IIe-2	Sandy Loam
MsB	Midessa fine sandy loam, 1 to 3 percent slopes	21	IIIe-3	IIIe-3	Sandy Loam
OtA	Olton loam, 0 to 1 percent slopes	22	IIIe-4	IIe-1	Deep Hardland
OtB	Olton loam, 1 to 3 percent slopes	22	IIIe-2	IIIe-2	Deep Hardland
PoB	Posey fine sandy loam, 0 to 3 percent slopes	23	IVe-2	IIIe-6	Mixedland Slopes
PoC	Posey fine sandy loam, 3 to 5 percent slopes	23	IVe-6	IVe-3	Mixedland Slopes
Pt	Potter gravelly loam	24	VIIs-1	------	Very Shallow
PuA	Pullman clay loam, 0 to 1 percent slopes	25	IIIe-5	IIs-1	Deep Hardland
PuB	Pullman clay loam, 1 to 3 percent slopes	25	IIIe-1	IIIe-1	Deep Hardland
Ra	Randall clay	26	VIw-1	------	----------
SpB	Springer loamy fine sand, 0 to 3 percent slopes	27	VIe-1	IVe-2	Sandyland
Tv	Tivoli fine sand	27	VIIe-1	------	Deep Sand
ZmA	Zita loam, 0 to 1 percent slopes	29	IIIe-4	IIe-1	Deep Hardland
ZmB	Zita loam, 1 to 3 percent slopes	29	IIIe-2	IIIe-2	Deep Hardland

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

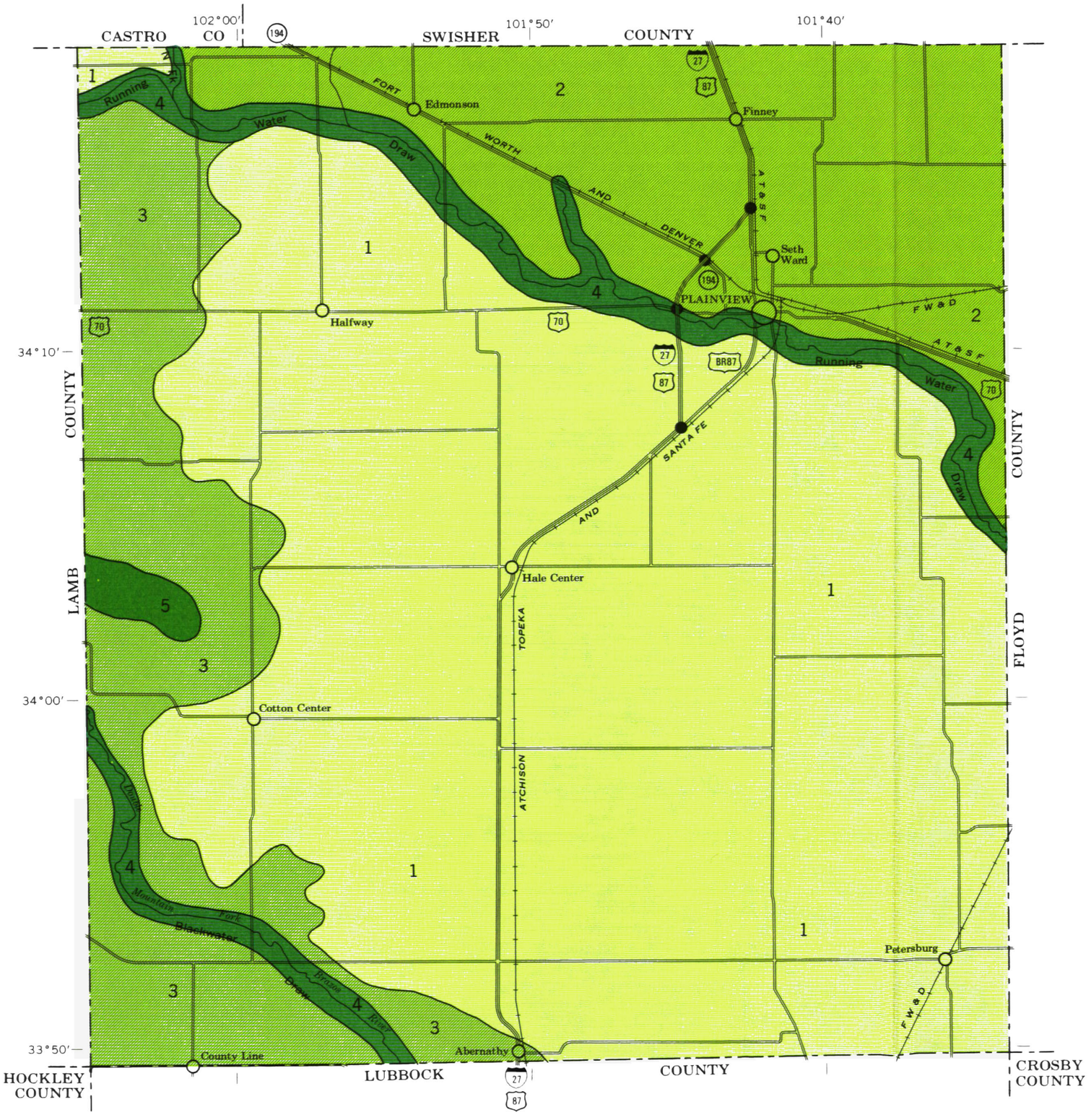
TEXAS AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

HALE COUNTY, TEXAS

Scale 1:253,440

1 0 1 2 3 4 Miles



N

SOIL ASSOCIATIONS *

1 Pullman-Olton association: Nearly level to gently sloping, noncalcareous clay loams and loams

2 Pullman association: Nearly level to gently sloping, noncalcareous clay loams

3 Olton-Amarillo-Acuff association: Nearly level to gently sloping, noncalcareous loams and fine sandy loams

4 Mansker-Bippus-Berda association: Nearly level to sloping, calcareous loams and fine sandy loams

5 Brownfield-Tivoli association: Nearly level to steep, noncalcareous fine sands

* Texture given in the title refers to texture of the surface layer of the major soils in each association.

Compiled 1972

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

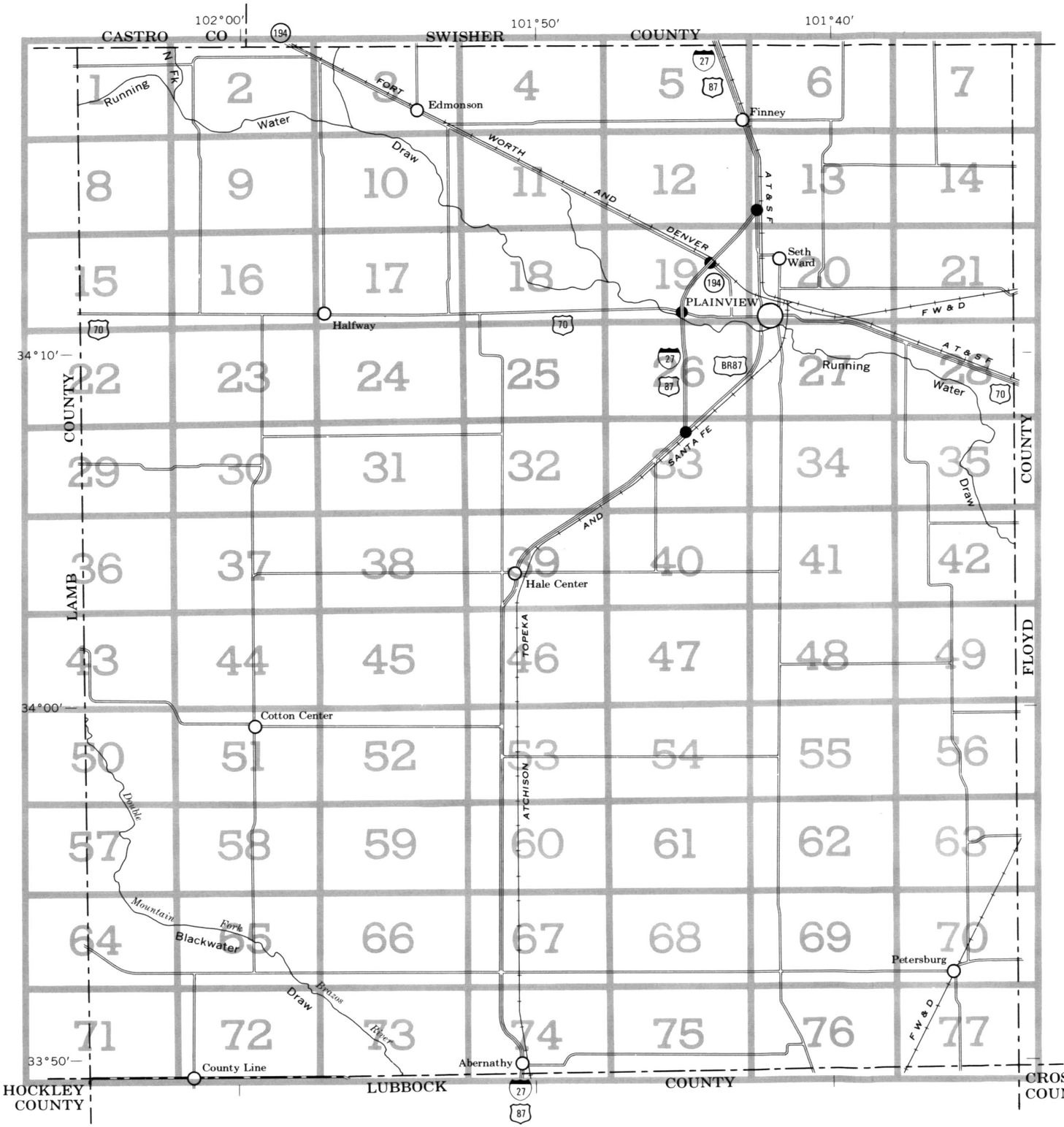
INDEX TO MAP SHEETS

HALE COUNTY, TEXAS

Scale 1:253,440

1 0 1 2 3 4 Miles

N



SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, or D, indicates the slope. Most symbols without a slope letter are those of nearly level soils, but some are for soils that have a considerable range of slope. (W) following the soil name indicates that signs of erosion, especially of local shifting of soil by wind, are evident in some places, but the degree of erosion cannot be estimated reliably.

SYMBOL	NAME
AcA	Acuff loam, 0 to 1 percent slopes
AcB	Acuff loam, 1 to 3 percent slopes
AlB	Amarillo loamy fine sand, 0 to 3 percent slopes (W)
AmA	Amarillo fine sandy loam, 0 to 1 percent slopes (W)
AmB	Amarillo fine sandy loam, 1 to 3 percent slopes (W)
AmC	Amarillo fine sandy loam, 3 to 5 percent slopes (W)
ArB	Arch loam, 0 to 3 percent slopes
BeC	Berda loam, 3 to 5 percent slopes
BeD	Berda loam, 5 to 8 percent slopes
BfA	Bippus fine sandy loam, overwash, 0 to 1 percent slopes
BfB	Bippus fine sandy loam, overwash, 1 to 3 percent slopes
BpA	Bippus loam, 0 to 1 percent slopes
BpB	Bippus loam, 1 to 3 percent slopes
Br	Brownfield fine sand (W)
DrB	Drake clay loam, 1 to 3 percent slopes (W)
DsD	Drake soils, 3 to 8 percent slopes (W)
EsA	Estacado loam, 0 to 1 percent slopes
EsB	Estacado loam, 1 to 3 percent slopes
Lo	Lofton clay loam
MkB	Mansker loam, 0 to 3 percent slopes
MkC	Mansker loam, 3 to 5 percent slopes
MsA	Midessa fine sandy loam, 0 to 1 percent slopes (W)
MsB	Midessa fine sandy loam, 1 to 3 percent slopes (W)
OtA	Olton loam, 0 to 1 percent slopes
OtB	Olton loam, 1 to 3 percent slopes
PoB	Posey fine sandy loam, 0 to 3 percent slopes (W)
PoC	Posey fine sandy loam, 3 to 5 percent slopes (W)
Pt	Potter gravelly loam
PuA	Pullman clay loam, 0 to 1 percent slopes
PuB	Pullman clay loam, 1 to 3 percent slopes
Ra	Randall clay
SpB	Springer loamy fine sand, 0 to 3 percent slopes (W)
Tv	Tivoli fine sand (W)
ZmA	Zita loam, 0 to 1 percent slopes
ZmB	Zita loam, 1 to 3 percent slopes

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Aqueduct

Well, irrigation

Well, oil or gas

Cotton gin

Windmill

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
- Unclassified

Canals and ditches

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

Prominent peak

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully

HALE COUNTY, TEXAS — SHEET NUMBER 1

HALE COUNTY, TEXAS NO. 1

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

605 000 FEET

990 000 FEET

980 000 FEET

625 000 FEET

CASTRO COUNTY

LAMB COUNTY

PREVIOUSLY PUBLISHED LAMB COUNTY TEXAS COUNTY BOUNDARY

2881

Running Water Draw

Valley View Church

18 17 3 21 19 16 2 20 2

OtA OtB PuA Lo Ra AcB BeC BeD BpA BpB EsA EsB MkB MkC Pt

(Joins sheet 2)

(Joins sheet 8)

N

1 Mile 5 000 Feet

Scale 1:20 000

HALE COUNTY, TEXAS — SHEET NUMBER 2

(2)

N

650 000 FEET

990 000 FEET

980 000 FEET

630 000 FEET

CASTRO COUNTY

SWISHER COUNTY

FORT WORTH AND DENVER

North Fork Running Water Draw

Running Water Draw

1 Mile

5 000 Feet

Scale 1:20 000

(Joins sheet 1)

(Joins sheet 3)

(Joins sheet 9)

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS NO. 2

HALE COUNTY, TEXAS — SHEET NUMBER 3

HALE COUNTY, TEXAS NO. 3

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

655 000 FEET

990 000 FEET

SWISHER COUNTY

FORT WORTH AND DENVER

Edmonson

Running Water Draw

(Joins sheet 2)

(Joins sheet 4)

(Joins sheet 10)

675 000 FEET

975 000 FEET

N

1 Mile 5 000 Feet

Scale 1:20 000

HALE COUNTY, TEXAS — SHEET NUMBER 4

4

N

700 000 FEET

990 000 FEET

SWISHER COUNTY

1 Mile 5 000 Feet

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

Scale 1:20 000

(Joins sheet 3)

975 000 FEET

680 000 FEET

(Joins sheet 11)

(Joins sheet 5)

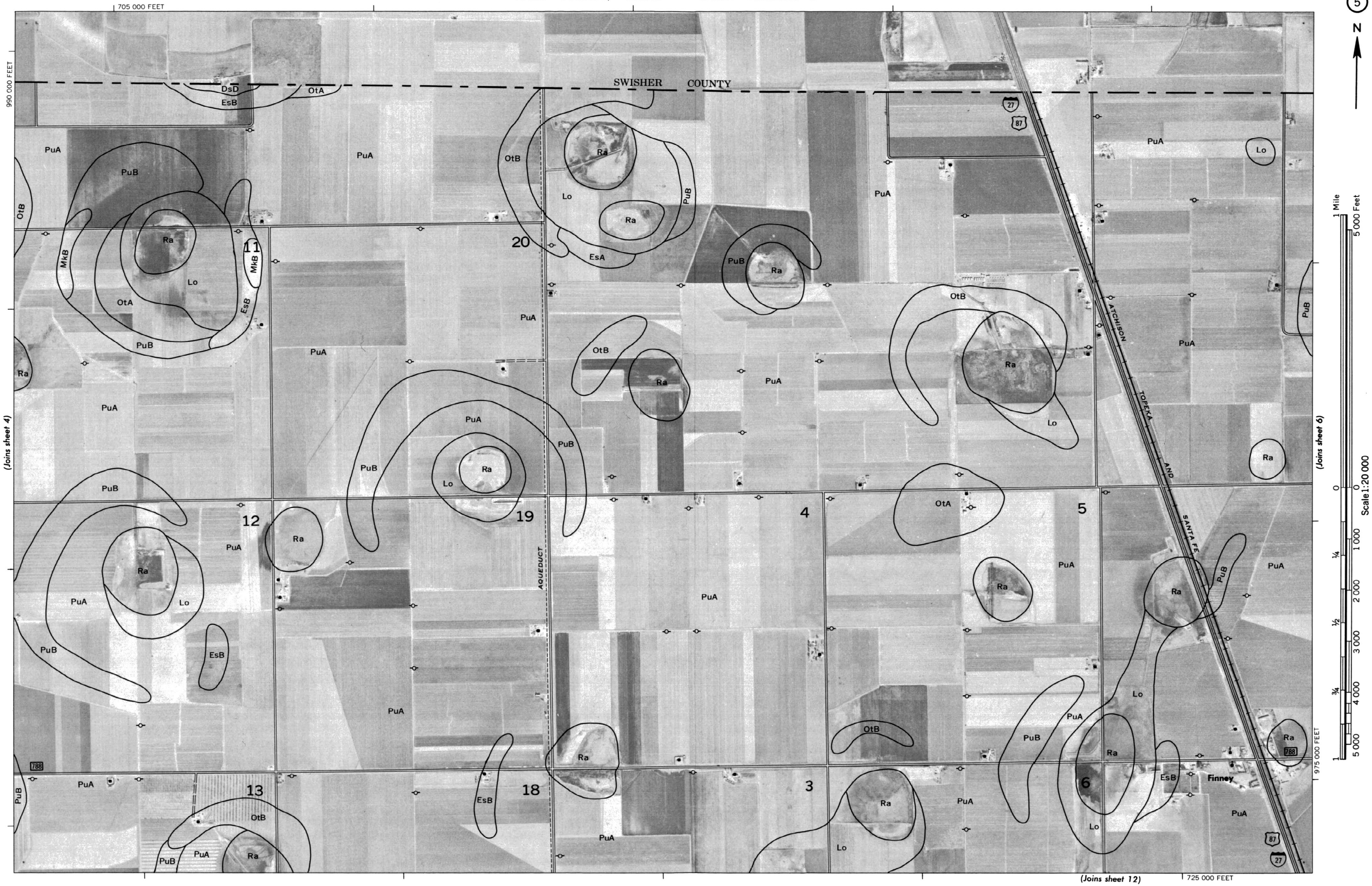
Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS NO. 4

HALE COUNTY, TEXAS — SHEET NUMBER 5



HALE COUNTY, TEXAS NO. 5

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

Land division corners are approximately positioned on this map.

HALE COUNTY, TEXAS — SHEET NUMBER 6

N

1 Mile
5 000 Feet
Scale 1:20 000
0 ¼ ½ ¾ 1
0 1 000 2 000 3 000 4 000 5 000

750 000 FEET

985 000 FEET

975 000 FEET

730 000 FEET

SWISHER COUNTY

(Joins sheet 5)

(Joins sheet 7)

(Joins sheet 13)

PuA PuB Ra Lo MkB ArB EsA EsB OtA

12 13 11 14

400 788

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS — SHEET NUMBER 7

HALE COUNTY, TEXAS NO. 7

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

755 000 FEET

985 000 FEET

975 000 FEET

775 000 FEET

INDEFINITE BOUNDARY

SWISHER COUNTY

FLOYD COUNTY

INDEFINITE BOUNDARY

30 29 26 27

1612

(Joins sheet 6)

(Joins sheet 14)

Ra Lo ArB OtA PuB MkB PuA EsB OtB

7

N

1 Mile 5 000 Feet

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

Scale 1:20 000

(8)

N

1 Mile
5 000 Feet
0
0
Scale 1:20 000
¼
1 000
½
2 000
¾
3 000
1
4 000
5 000

965 000 FEET

605 000 FEET

625 000 FEET

975 000 FEET

(Joins sheet 1)

(Joins sheet 9)

(Joins sheet 15)

LAMB COUNTY

PREVIOUSLY PUBLISHED LAMB COUNTY TEXAS COUNTY BOUNDARY

OtA PuA AcA EsB EsA MkB Ra OtB MkC PoC AmA MsB AcB AmB

2 3 7 8 9 12 13 14

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS — SHEET NUMBER 9

HALE COUNTY, TEXAS NO. 9

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

630 000 FEET

975 000 FEET

960 000 FEET

650 000 FEET

(Joins sheet 2)

(Joins sheet 8)

(Joins sheet 10)

(Joins sheet 16)

9

N

1 Mile
5 000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

(Joins sheet 3)

675 000 FEET

975 000 FEET

960 000 FEET

655 000 FEET

N

1 Mile 5 000 Feet

0 0 Scale 1:20 000 (Joins sheet 9)

¼ 1 000 2 000

½ 3 000

¾ 4 000

1 5 000

(Joins sheet 17)

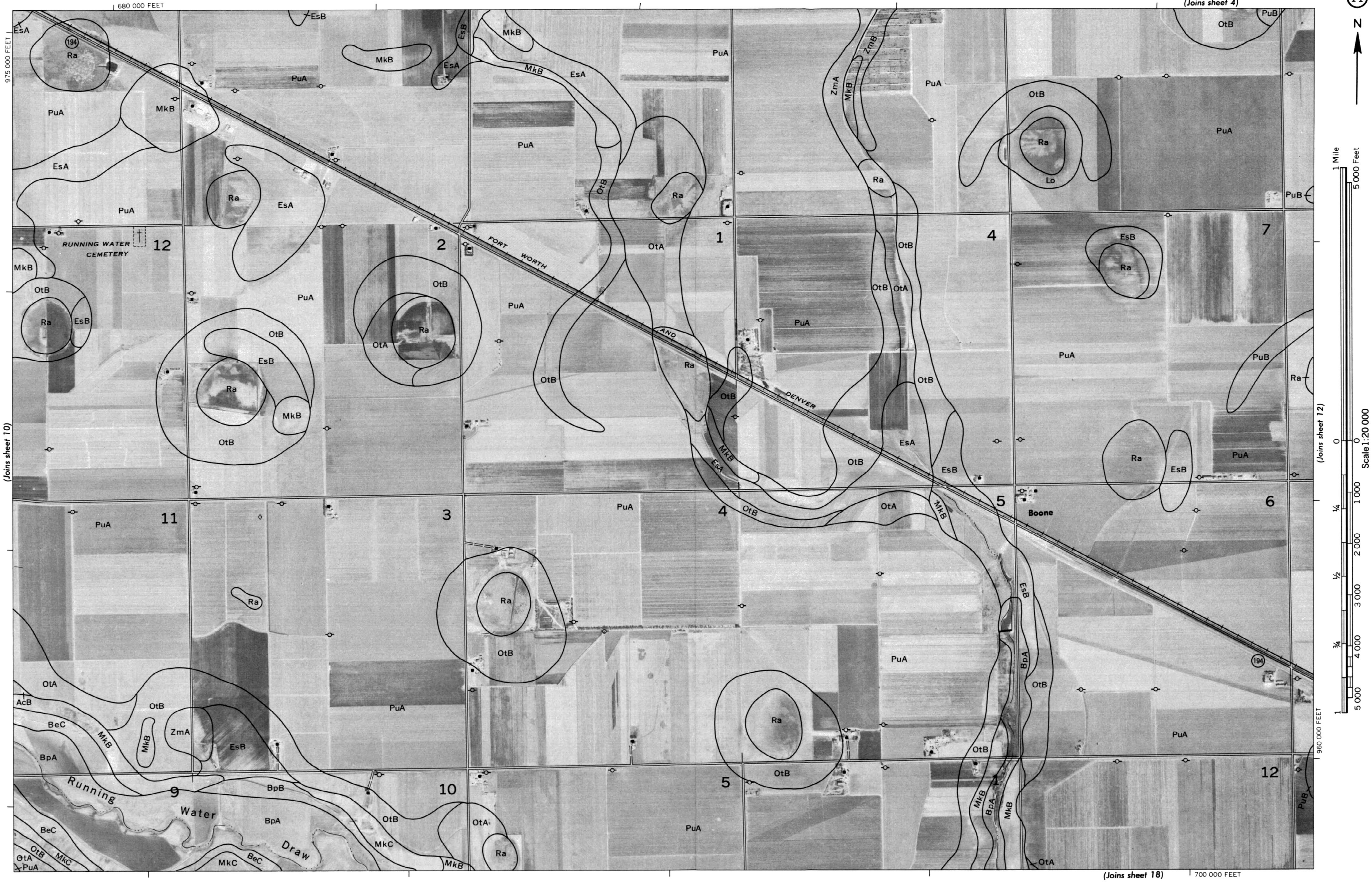
(Joins sheet 11)

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS NO. 10



HALE COUNTY, TEXAS NO. 11
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

HALE COUNTY, TEXAS — SHEET NUMBER 12

N

1 Mile
5 000 Feet
Scale 1:20 000

(Joins sheet 5)
(Joins sheet 11)
(Joins sheet 19)
(Joins sheet 13)

725 000 FEET
970 000 FEET
960 000 FEET
705 000 FEET

AQUEDUCT

FORT WORTH AND DENVER

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS NO. 12

HALE COUNTY, TEXAS — SHEET NUMBER 13

13

N

730 000 FEET

970 000 FEET

960 000 FEET

750 000 FEET

(Joins sheet 6)

(Joins sheet 12)

(Joins sheet 14)

(Joins sheet 20)

1 Mile

5 000 Feet

Scale 1:20 000

0 1 000 2 000 3 000 4 000 5 000

¼ ½ ¾ 1

HALE COUNTY, TEXAS NO. 13

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

HALE COUNTY, TEXAS — SHEET NUMBER 14

(14)

N

(Joins sheet 7)

775 000 FEET

970 000 FEET

960 000 FEET

(Joins sheet 13)

(Joins sheet 21)

755 000 FEET

1 Mile

5 000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

Prarie View

116 118 113 112 111 110 109 95 96 97 98

FLOYD COUNTY

INDEFINITE BOUNDARY

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

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HALE COUNTY, TEXAS NO. 14

HALE COUNTY, TEXAS NO. 15

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

16

N

1 Mile

5 000 Feet

Scale 1:20 000

0 0

¼ 1 000

½ 2 000

¾ 4 000

1 5 000

(Joins sheet 9)

650 000 FEET

955 000 FEET

(Joins sheet 17)

(Joins sheet 15)

945 000 FEET

630 000 FEET

(Joins sheet 23)

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

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HALE COUNTY, TEXAS NO. 16

HALE COUNTY, TEXAS — SHEET NUMBER 17

HALE COUNTY, TEXAS NO. 17

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Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

655 000 FEET

955 000 FEET

945 000 FEET

675 000 FEET

(Joins sheet 16)

(Joins sheet 10)

(Joins sheet 18)

(Joins sheet 24)

17

N

1 Mile 5 000 Feet

Scale 1:20 000

1 0 1 2 3 4 5 Kilometers

Halfway

HALFWAY CEMETERY

179 1424 1070 70

(Joins sheet 11)

700 000 FEET

955 000 FEET

(Joins sheet 19)

N

1 Mile 5 000 Feet

0 0

Scale 1:20 000

(Joins sheet 17)

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

945 000 FEET

(Joins sheet 25)

680 000 FEET

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS NO. 19

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Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

705 000 FEET

955 000 FEET

945 000 FEET

725 000 FEET

(Joins sheet 18)

(Joins sheet 12)

(Joins sheet 20)

(Joins sheet 26)

19

N

1 Mile

5000 Feet

Scale 1:20 000

Wasson

FORT WORTH AND DENVER

AQUEDUCT

Running Water Draw

PLAINVIEW
(county seat)

11 14 23 26 35

10 15 22 27 34

9 16 21 28 33

EsB EsA PuA PuB MkB MkC OtA OtB BeC BpA BpB Ra Lo

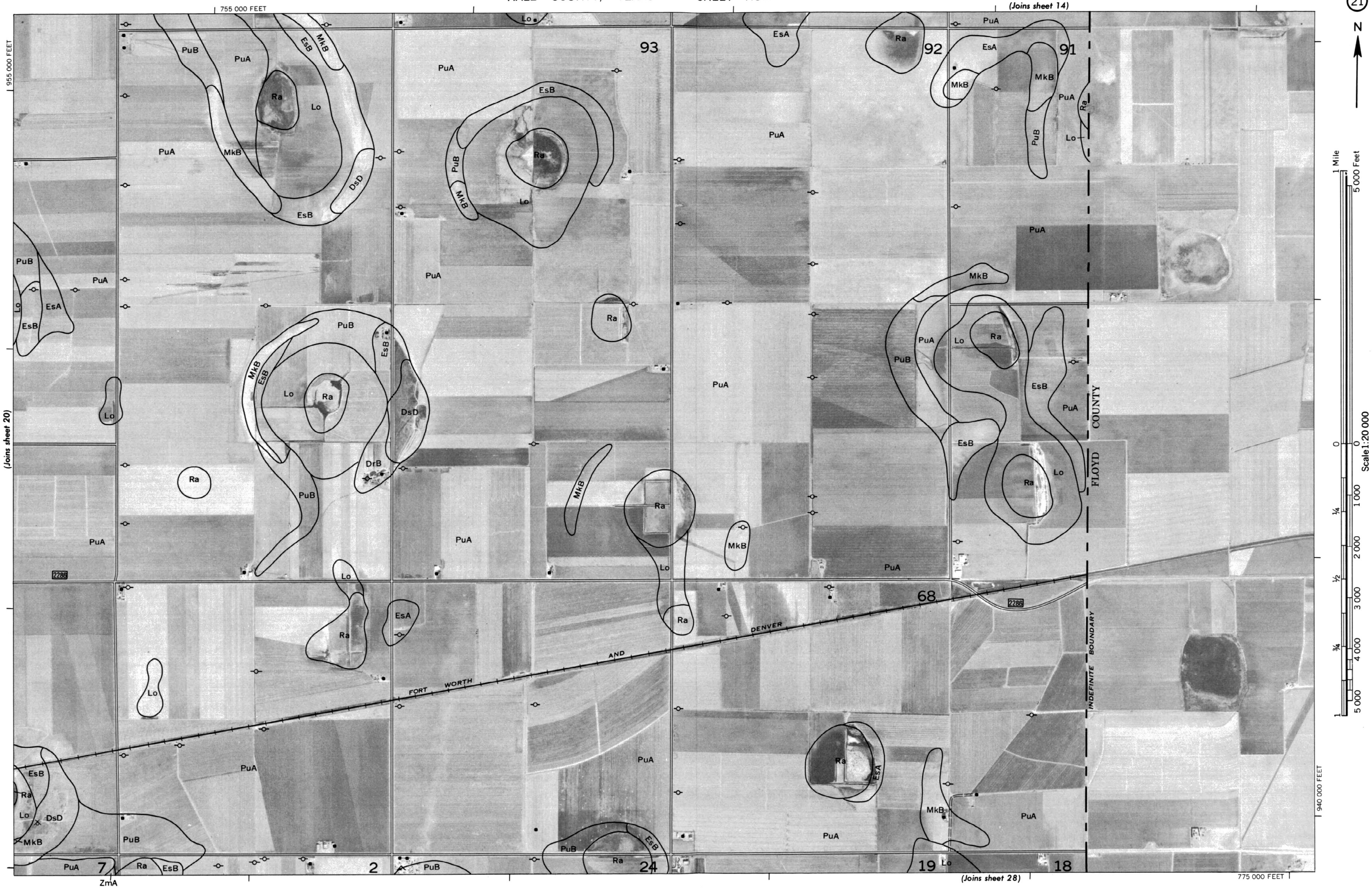
HALE COUNTY, TEXAS — SHEET NUMBER 20

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS — SHEET NUMBER 21



HALE COUNTY, TEXAS NO. 21

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

N

1 Mile 5 000 Feet

0 0

Scale 1:20 000

¼ 1 000

½ 2 000

¾ 4 000

1 5 000

625 000 FEET

940 000 FEET

930 000 FEET

605 000 FEET

(Joins sheet 15)

(Joins sheet 23)

(Joins sheet 29)

PREVIOUSLY PUBLISHED LAMB COUNTY

TEXAS COUNTY BOUNDARY

15 10 3

16 9 4

17 8 5

OtA OtB AcA AcB EsA EsB Lo MkB MkC PuA PuB Ra ZmA

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS — SHEET NUMBER 23

630 000 FEET

940 000 FEET

930 000 FEET

650 000 FEET

(Joins sheet 16)

(Joins sheet 22)

(Joins sheet 24)

(Joins sheet 30)

23

N

1 Mile

5 000 Feet

Scale 1:20 000

0 0

1/4 1 000

1/2 2 000

3/4 3 000

1 4 000

5 000

34 27 22 15

33 28 21 16

32 29 20 17

OtA OtB Lo PuA ZmA Ra EsB DsD MkC AmB MkB AcB EsA PuB AcA

179

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

HALE COUNTY, TEXAS NO. 23

HALE COUNTY, TEXAS — SHEET NUMBER 24

(24)

N

(Joins sheet 17)

675 000 FEET

940 000 FEET

1 Mile

5 000 Feet

Scale 1:20 000

(Joins sheet 23)

930 000 FEET

(Joins sheet 31)

655 000 FEET

(Joins sheet 25)

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS NO. 24

HALE COUNTY, TEXAS — SHEET NUMBER 25

680 000 FEET

940 000 FEET

(Joins sheet 18)

(Joins sheet 24)

(Joins sheet 26)

930 000 FEET

700 000 FEET

(Joins sheet 32)

25

N

1424

16 17 18 5

64 63 62 61

49 50 51 52

48 47 46 45

PuA PuB OtB OtA MkB MkC Ra Lo EsB ZmA

1 Mile 5 000 Feet

Scale 1:20 000

HALE COUNTY, TEXAS NO. 25

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

N

Scale 1:20 000

1 Mile 5 000 Feet

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

(Joins sheet 19)

(Joins sheet 25)

(Joins sheet 27)

(Joins sheet 33)

725 000 FEET

940 000 FEET

930 000 FEET

705 000 FEET

PLAINVIEW (county seat)

COUNTRY CLUB

Running Water Draw

PLAINVIEW MEMORIAL PARK CEMETERY

IOOF CEM

PLAINVIEW CEM

HALE COUNTY AIRPORT

AQUEDUCT

SANTA FE AND TOPEKA ATCHISON

20 29 32 60 9 30 31 53 54 55 56

PuA OtA OtB Ra MkB MkC Lo BpB PuB

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

730 000 FEET

940 000 FEET

(Joins sheet 20)

(Joins sheet 26)

(Joins sheet 28)

(Joins sheet 34)

925 000 FEET

750 000 FEET

27

N

1 Mile

5 000 Feet

Scale 1:20 000

PLAINVIEW
(county seat)

HALE COUNTY AIRPORT

PLAINVIEW CEMETERY

IOOF CEM

GRAVEL PIT

Running Water Draw

Running Water Draw

SANTA FE

ATCHISON TOPEKA AND SANTA FE

TOPEKA AND SANTA FE

ATCHISON TOPEKA AND SANTA FE

BR 87

70

400

41 42 15 14 13 12 10 11 21 28 29

(Joins sheet 21)

775 000 FEET

935 000 FEET

925 000 FEET

750 000 FEET

(Joins sheet 35)

N

1 Mile 5 000 Feet

Scale 1:20 000

(Joins sheet 27)

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS NO. 28

COUNTY

FLOYD

INDEFINITE BOUNDARY

ATCHISON, TOPEKA AND SANTA FE

Running Water Draw

7 2 24 19 18

6 3 23 20 17

5 4 22 21

32 33 35 38

PuA PuB DsD DrB Ra EsA EsB AcB AmA BpA MkB MkC Lo OtA OtB ZmA

HALE COUNTY, TEXAS — SHEET NUMBER 29

605 000 FEET

925 000 FEET

(Joins sheet 22)

29

N

1 Mile

5 000 Feet

(Joins sheet 30)

Scale 1:20 000

915 000 FEET

(Joins sheet 36)

625 000 FEET

HALE COUNTY, TEXAS NO. 29

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

LAMB COUNTY

PREVIOUSLY PUBLISHED LAMB COUNTY TEXAS COUNTY BOUNDARY

AcA AcB DrB DsD EsA EsB Lo MkB MkC OtA OtB Ra ZmA

18 7 6 8 36 18 17 9 35 19 20

HALE COUNTY, TEXAS — SHEET NUMBER 30

(30)

N

(Joins sheet 23)

650 000 FEET

925 000 FEET

(Joins sheet 29)

915 000 FEET

630 000 FEET

(Joins sheet 37)

(Joins sheet 31)

Scale 1:20 000

1 Mile 5000 Feet

0 0 ¼ 1 000 ½ 2 000 ¾ 4 000 1 5 000

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS NO. 30

Mayfield

Mayfield Church

HALE COUNTY, TEXAS — SHEET NUMBER 31

655 000 FEET

925 000 FEET

915 000 FEET

675 000 FEET

(Joins sheet 24)

(Joins sheet 30)

(Joins sheet 32)

(Joins sheet 38)

31

N

1 Mile

5 000 Feet

Scale 1:20 000

0 0 ¼ ½ ¾ 1

1 000 2 000 3 000 4 000 5 000

HALE COUNTY, TEXAS NO. 31

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

HALE COUNTY, TEXAS — SHEET NUMBER 32

(32)

N

(Joins sheet 25)

700 000 FEET

925 000 FEET

915 000 FEET

680 000 FEET

(Joins sheet 39)

(Joins sheet 33)

(Joins sheet 31)

Scale 1:20 000

1 Mile 5 000 Feet

0 0 ¼ 1 000 ½ 2 000 ¾ 3 000 1 4 000 5 000

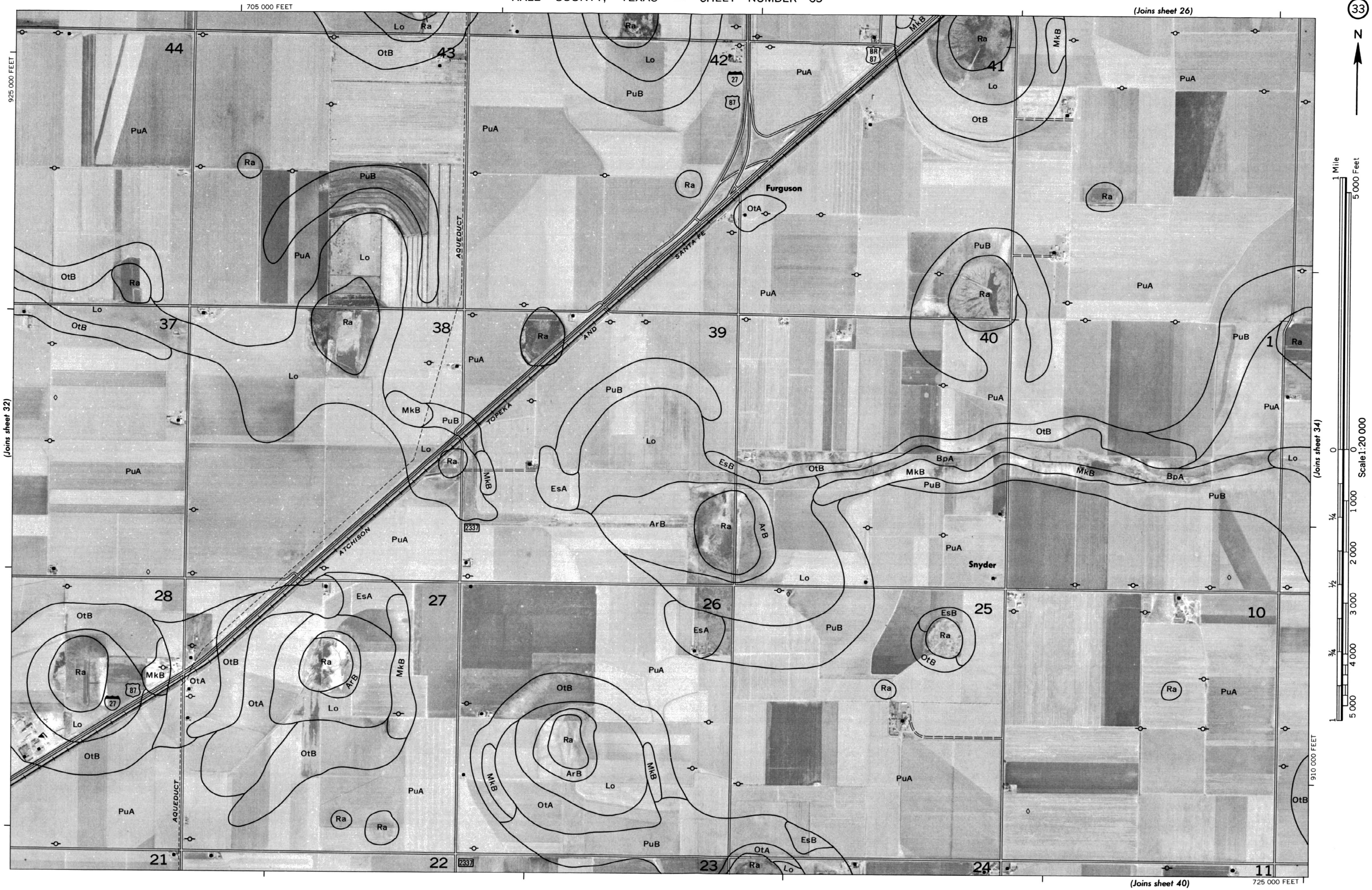
Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS NO. 32

HALE COUNTY, TEXAS — SHEET NUMBER 33



HALE COUNTY, TEXAS NO. 33

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

Land division corners are approximately positioned on this map.

N

1 Mile

5 000 Feet

Scale 1:20 000

0 0 ¼ ½ ¾ 1

1 000 2 000 3 000 4 000 5 000

(Joins sheet 27)

(Joins sheet 33)

(Joins sheet 35)

(Joins sheet 41)

750 000 FEET

920 000 FEET

910 000 FEET

725 000 FEET

PuA PuB OtB OtA Lo Ra EsA EsB MkB ArB Callahan Draw

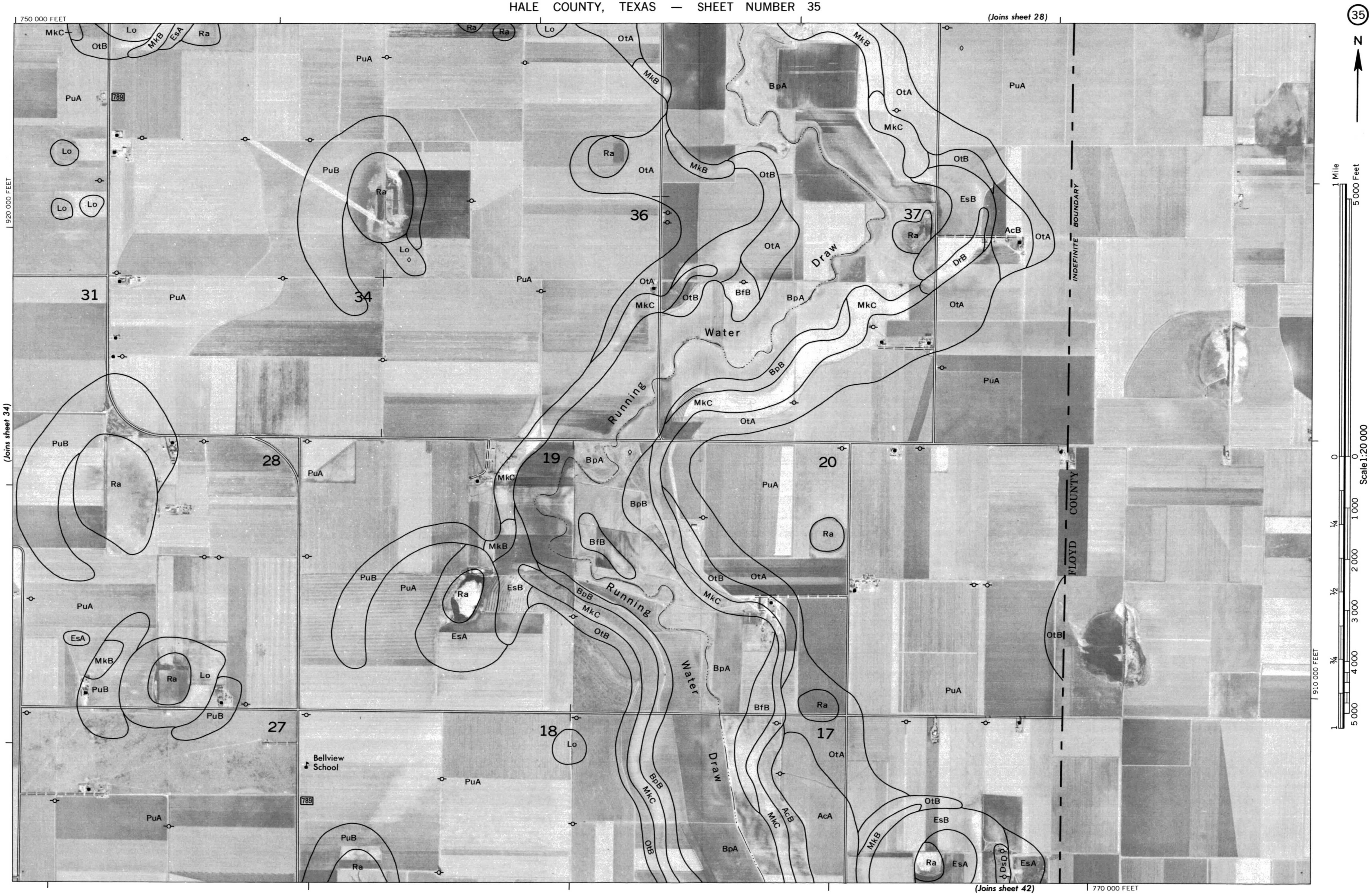
25 26 27 2 3 4 5 9 8 7 6 12 13 14 15 32 30 29

400

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.



HALE COUNTY, TEXAS NO. 35
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

N

1 Mile 5 000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

(Joins sheet 29)

625 000 FEET

910 000 FEET

900 000 FEET

605 000 FEET

(Joins sheet 37)

(Joins sheet 43)

PREVIOUSLY PUBLISHED COUNTY BDY

LAMB COUNTY

EsA AcB AmA AmB Ra OtA OtB EsB DrB AcA Lo AlB Tv Br SpB PoB AmC MsB ZmA

12 13 16 24 25 26 31 32 35 30

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS NO. 37

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

630 000 FEET

910 000 FEET

(Joins sheet 30)

(Joins sheet 36)

(Joins sheet 38)

(Joins sheet 44)

650 000 FEET

895 000 FEET

37

N

1 Mile
5 000 Feet

Scale 1:20 000

Sherrod Landing Strip

CENTER PLAINS CEMETERY

N

1 Mile 5 000 Feet

Scale 1:20 000

0 0 ¼ 1 000 ½ 2 000 ¾ 4 000 1 5 000

(Joins sheet 37)

(Joins sheet 31)

675 000 FEET

910 000 FEET

(Joins sheet 39)

(Joins sheet 45)

655 000 FEET

895 000 FEET

OtB Ra Lo OtA PuA MkC EsB DsD EsA ZmA ArB MkB ZmB DrB AmB

HALE CENTER CEMETERY

LAKESIDE PARK COUNTRY CLUB

1914

3 4 5 6 9 10

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS — SHEET NUMBER 39

HALE COUNTY, TEXAS NO. 39

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

680 000 FEET

910 000 FEET

895 000 FEET

695 000 FEET

(Joins sheet 32)

(Joins sheet 38)

(Joins sheet 40)

(Joins sheet 46)

39

N

1 Mile

5 000 Feet

Scale 1:20 000

1 5 000 ¾ 4 000 ½ 3 000 ¼ 2 000 0 0 ¼ 1 000 ½ 2 000 ¾ 3 000 1 4 000 1 5 000

Hale Center

High School

Akin School

Boyd Air Strip

HALE CENTER CEMETERY

SANTA FE

TOPEKA AND SANTA FE

ATCHISON

SEWAGE DISPOSAL

1424 1914 87 27

PuA OtB Ra OtA MkB MkC Lo EsA EsB ZmA PuB ArB AmA AmB DsD DrB

HALE COUNTY, TEXAS — SHEET NUMBER 40

(40)

N

(Joins sheet 33)

725 000 FEET

905 000 FEET

(Joins sheet 41)

(Joins sheet 39)

895 000 FEET

700 000 FEET

(Joins sheet 47)

1 Mile

5 000 Feet

Scale 1:20 000

0 0 ¼ 1 000 ½ 2 000 ¾ 4 000 1 5 000

21 22 23 24 11

12 11 10 9 20

5 6 7 8 21

AQUEDUCT

PuA PuB MkB OtB OtA Ra Lo EsA EsB ZmA

1914 2337

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS NO. 40

HALE COUNTY, TEXAS — SHEET NUMBER 41

HALE COUNTY, TEXAS NO. 41

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

725 000 FEET

905 000 FEET

(Joins sheet 40)

(Joins sheet 34)

(Joins sheet 42)

895 000 FEET

745 000 FEET

(Joins sheet 48)

41

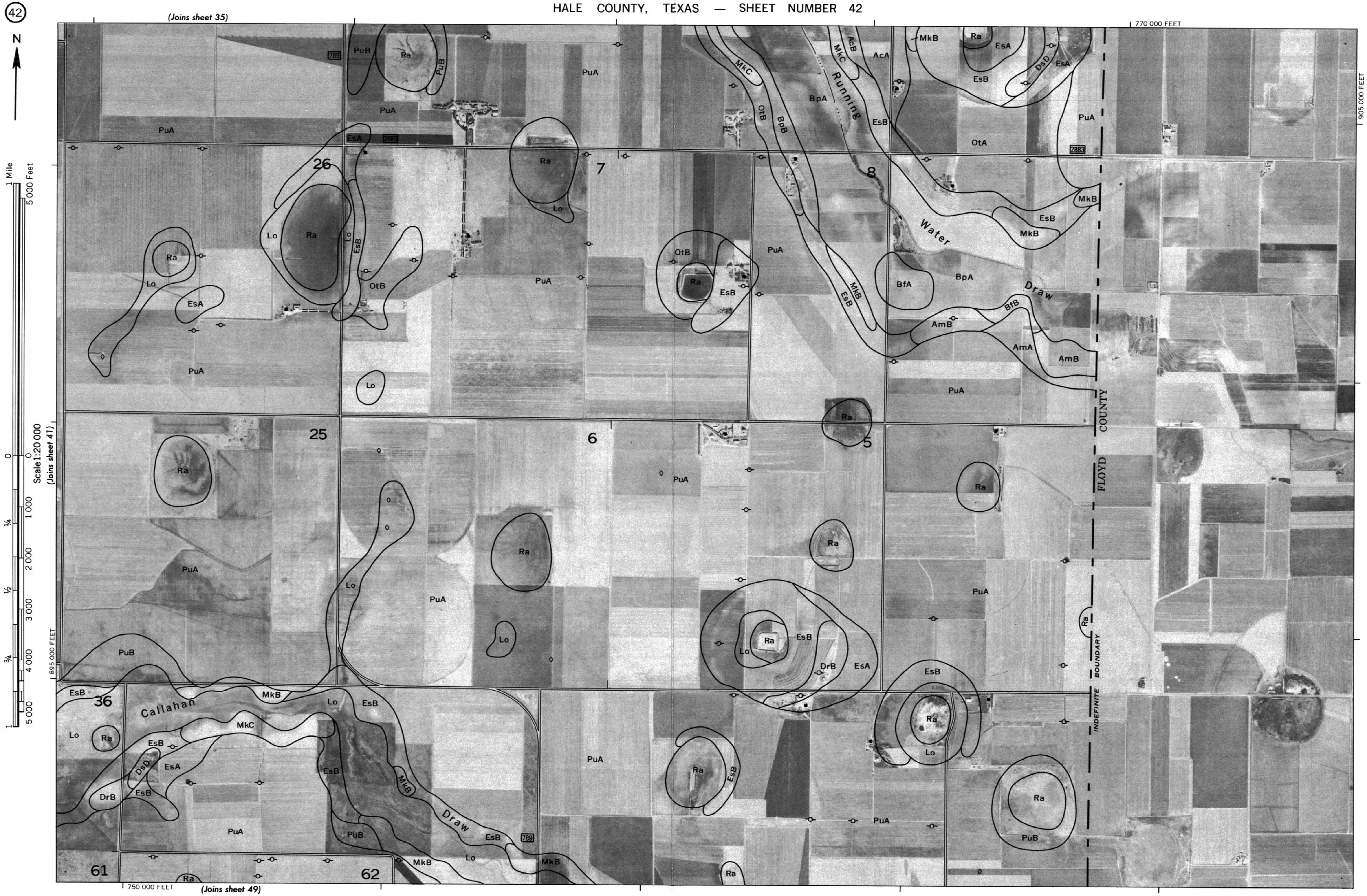
N

1 Mile
5 000 Feet

Scale 1:20 000

1 5 000
¾ 4 000
½ 2 000
¼ 1 000
0 0

HALE COUNTY, TEXAS — SHEET NUMBER 42



Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

43

(Joins sheet 36)

N

(Joins sheet 44)

Scale 1:20 000

1 Mile, 0, ¼, ½, ¾, 1

5 000 Feet, 0, 1000, 2000, 3000, 4000, 5 000

(Joins sheet 50)

HALE COUNTY, TEXAS NO. 43

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

HALE COUNTY, TEXAS — SHEET NUMBER 44

(44)

N

(Joins sheet 37)

650 000 FEET

895 000 FEET

1 Mile

5 000 Feet

Scale 1:20 000

(Joins sheet 43)

(Joins sheet 45)

880 000 FEET

630 000 FEET

37

(Joins sheet 51)

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS — SHEET NUMBER 45

HALE COUNTY, TEXAS NO. 45

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

655 000 FEET

895 000 FEET

(Joins sheet 38)

(Joins sheet 44)

(Joins sheet 46)

880 000 FEET

670 000 FEET

(Joins sheet 52)

45

N

1 Mile

5 000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

N

(Joins sheet 39)

695 000 FEET

890 000 FEET

880 000 FEET

675 000 FEET

(Joins sheet 53)

(Joins sheet 45)

(Joins sheet 47)

1 Mile

5 000 Feet

Scale 1:20 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

1¼ 5 000

8 16 15 14 13

21 17 18 19 20

35 32 31 30

SANTA FE

TOPEKA AND ATCHISON

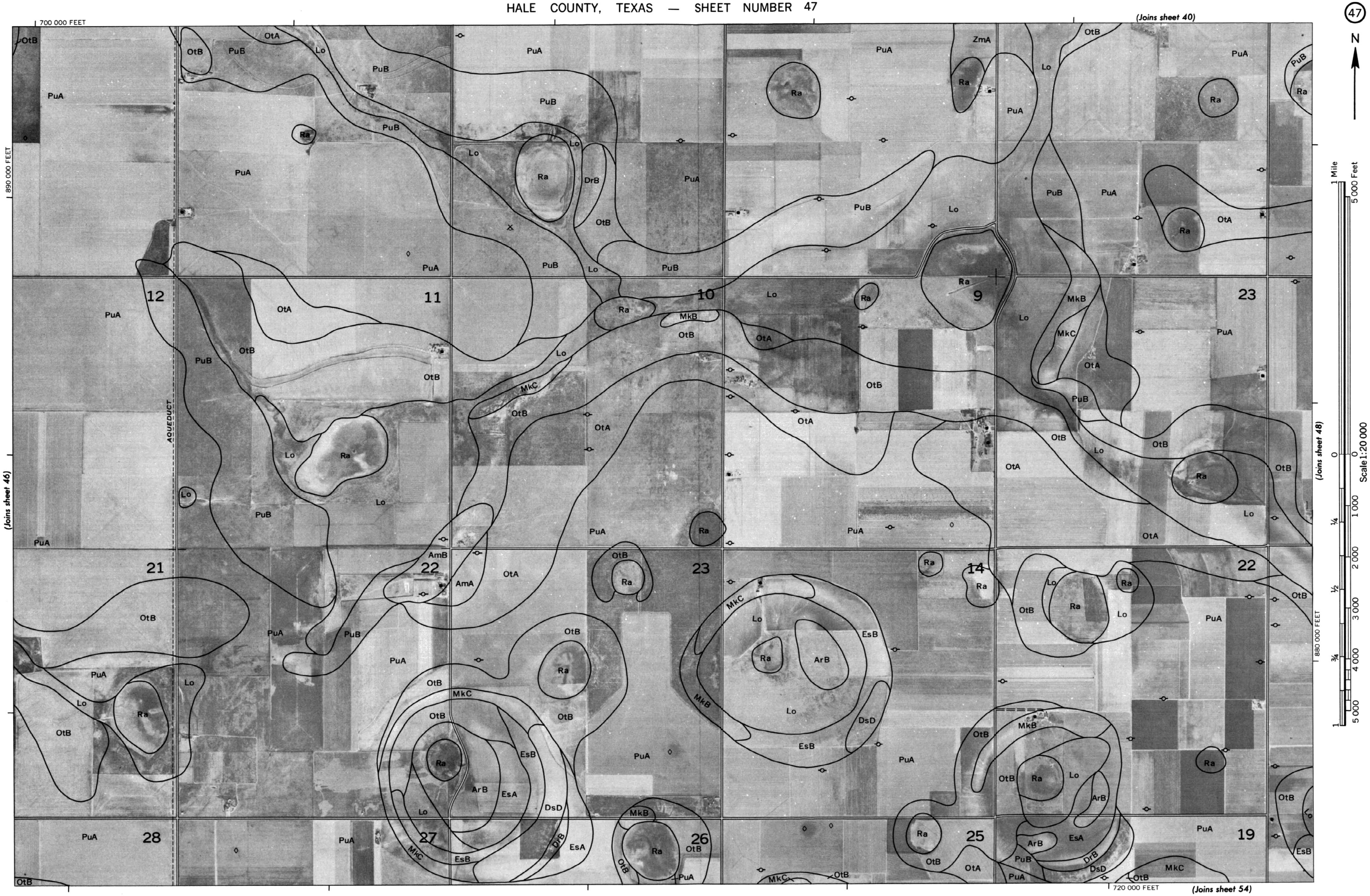
87 27

PuA PuB PuC PuD Ra Lo OtA OtB EsA EsB ArB MkB MkC DsD ZmA ZmB AmA AmB DrB

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.



HALE COUNTY, TEXAS NO. 47

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

N

(Joins sheet 41)

745 000 FEET

890 000 FEET

1 Mile

5 000 Feet

Scale 1:20 000

(Joins sheet 47)

880 000 FEET

725 000 FEET

(Joins sheet 55)

(Joins sheet 49)

Happy Union Community Center

Happy Union

Happy Union Church

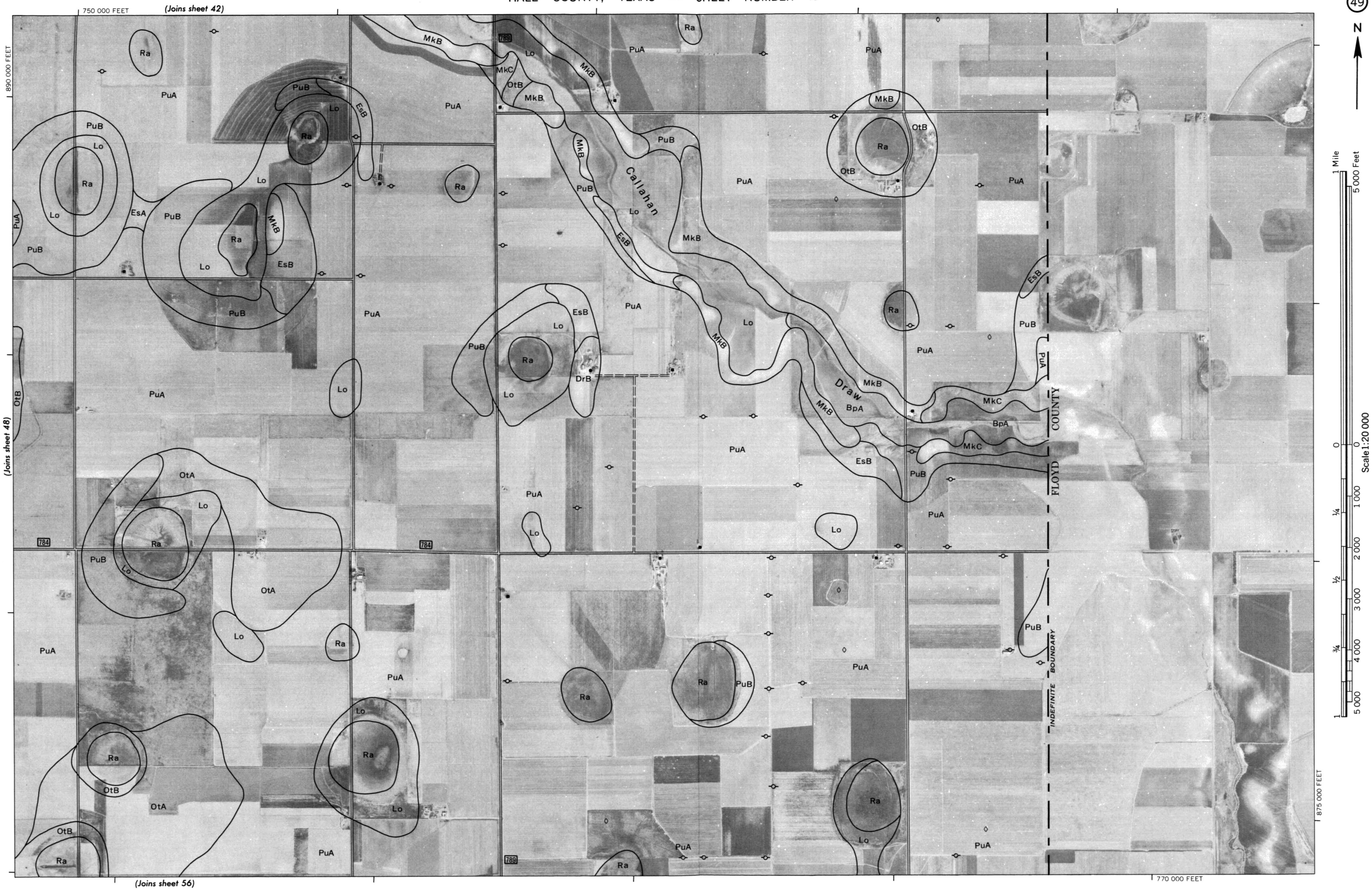
24 29 30 30 21 28 27 32 20 5 6 33

PuA PuB Ra OtA OtB Lo MkB MkC EsB EsA DsD ArB

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.



HALE COUNTY, TEXAS NO. 49

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

HALE COUNTY, TEXAS — SHEET NUMBER 50

(50)

N

1 Mile 5 000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

(Joins sheet 43)

625 000 FEET

875 000 FEET

865 000 FEET

605 000 FEET

(Joins sheet 51)

(Joins sheet 57)

PREVIOUSLY PUBLISHED LAMB COUNTY, TEXAS COUNTY BOUNDARY

LAMB COUNTY

Blackwater Draw

Double Mountain Fork

Brazos River

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS NO. 50

HALE COUNTY, TEXAS — SHEET NUMBER 51

HALE COUNTY, TEXAS NO. 51

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

630 000 FEET

875 000 FEET

865 000 FEET

645 000 FEET

(Joins sheet 44)

(Joins sheet 50)

(Joins sheet 52)

(Joins sheet 58)

Cotton Center

51

N

1 Mile

5 000 Feet

0 0

Scale 1:20 000

1/4 1 000

1/2 2 000

3/4 3 000

1 4 000

5 000

N

(Joins sheet 45)

670 000 FEET

875 000 FEET

(Joins sheet 51)

(Joins sheet 53)

865 000 FEET

650 000 FEET

(Joins sheet 59)

1 Mile

5 000 Feet

Scale 1:20 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

31 32 33 34

40 39 38 37

46 47 48 49

AmC AmB AmA AcB BcV BpA DsD EsB EsA MkC MkB MsB OtA OtB PuA PuB Ra Lo ZmA ZmB

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

675 000 FEET

875 000 FEET

(Joins sheet 46)

(Joins sheet 52)

(Joins sheet 54)

865 000 FEET

695 000 FEET

(Joins sheet 60)

Underwood

SANTA FE AND TOPEKA ATCHISON

N

1 Mile 5000 Feet

Scale 1:20 000

0 0 ¼ 1 000 ½ 2 000 ¾ 3 000 1 4 000 5 000

N

(Joins sheet 47)

720 000 FEET

875 000 FEET

865 000 FEET

700 000 FEET

1 Mile

5 000 Feet

Scale 1:20 000

(Joins sheet 53)

(Joins sheet 55)

(Joins sheet 61)

AQUEDUCT

37 38 39 40 18

44 43 42 41 15

53 54 55 56 14

OtB PuA Ra Lo MkC MkB EsB DsD DrB EsA AcB ArB MsB AmB AmA OtA BpA PuB

HALE COUNTY, TEXAS — SHEET NUMBER 55

55

N

725 000 FEET

875 000 FEET

(Joins sheet 48)

(Joins sheet 54)

(Joins sheet 56)

(Joins sheet 62)

745 000 FEET

860 000 FEET

1 Mile

5 000 Feet

Scale 1:20 000

HALE COUNTY, TEXAS NO. 55

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

HALE COUNTY, TEXAS — SHEET NUMBER 56

(56)

N

(Joins sheet 49)

770 000 FEET

870 000 FEET

(Joins sheet 55)

860 000 FEET

(Joins sheet 63)

750 000 FEET

Scale 1:20 000

1 Mile | 5 000 Feet

0 | 0

¼ | 1 000

½ | 2 000

¾ | 4 000

1 | 5 000

35 | 57 | 38 | 39 | 54 | 55 | 1 | 4 | 3 | 2

789 | 784

FLOYD COUNTY

INDEFINITE BOUNDARY

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station

HALE COUNTY, TEXAS, NO. 56

HALE COUNTY, TEXAS — SHEET NUMBER 57

605 000 FEET

860 000 FEET

(Joins sheet 50)

(Joins sheet 58)

850 000 FEET

620 000 FEET

(Joins sheet 64)

57

N

1 Mile

5 000 Feet

Scale 1:20 000

HALE COUNTY, TEXAS NO. 57

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

PREVIOUSLY PUBLISHED LAMB COUNTY TEXAS COUNTY BOUNDARY

LAMB COUNTY

Double Blackwater Draw

Blackwater Draw

Brazos River Fork

Mountain

Lo

51 50 46 29 28 27 22 23 24 19 18 17

HALE COUNTY, TEXAS — SHEET NUMBER 58

(58)

N

(Joins sheet 51)

645 000 FEET

860 000 FEET

850 000 FEET

625 000 FEET

(Joins sheet 57)

(Joins sheet 59)

(Joins sheet 65)

1 Mile 5 000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

EsB EsA AcB AcA Ra PuA MkB OtB OtA AmB ZmA ZmB Lo AmC PoC MsA AmA

9 12 2 102 99 98 18 13 8 3 101 100 97 4 6 14

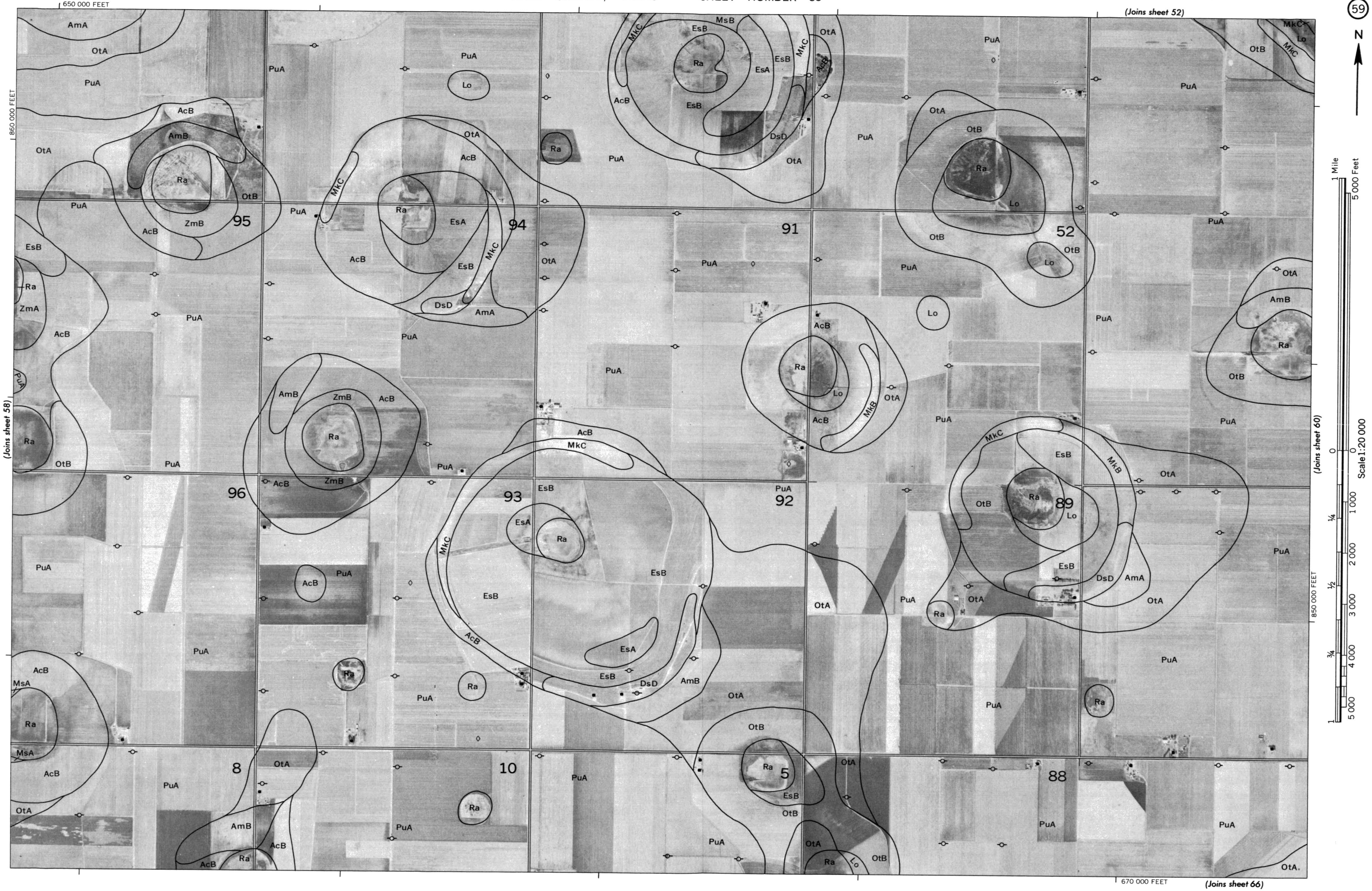
179

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS NO. 58



HALE COUNTY, TEXAS NO. 59

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

60

N

(Joins sheet 53)

695 000 FEET

860 000 FEET

850 000 FEET

675 000 FEET

(Joins sheet 67)

(Joins sheet 61)

(Joins sheet 59)

Scale 1:20 000

1 Mile 5 000 Feet

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

1 5 000

SANTA FE

TOPEKA

ATCHISON

51 64 63 62 61

90 65 66 67 1

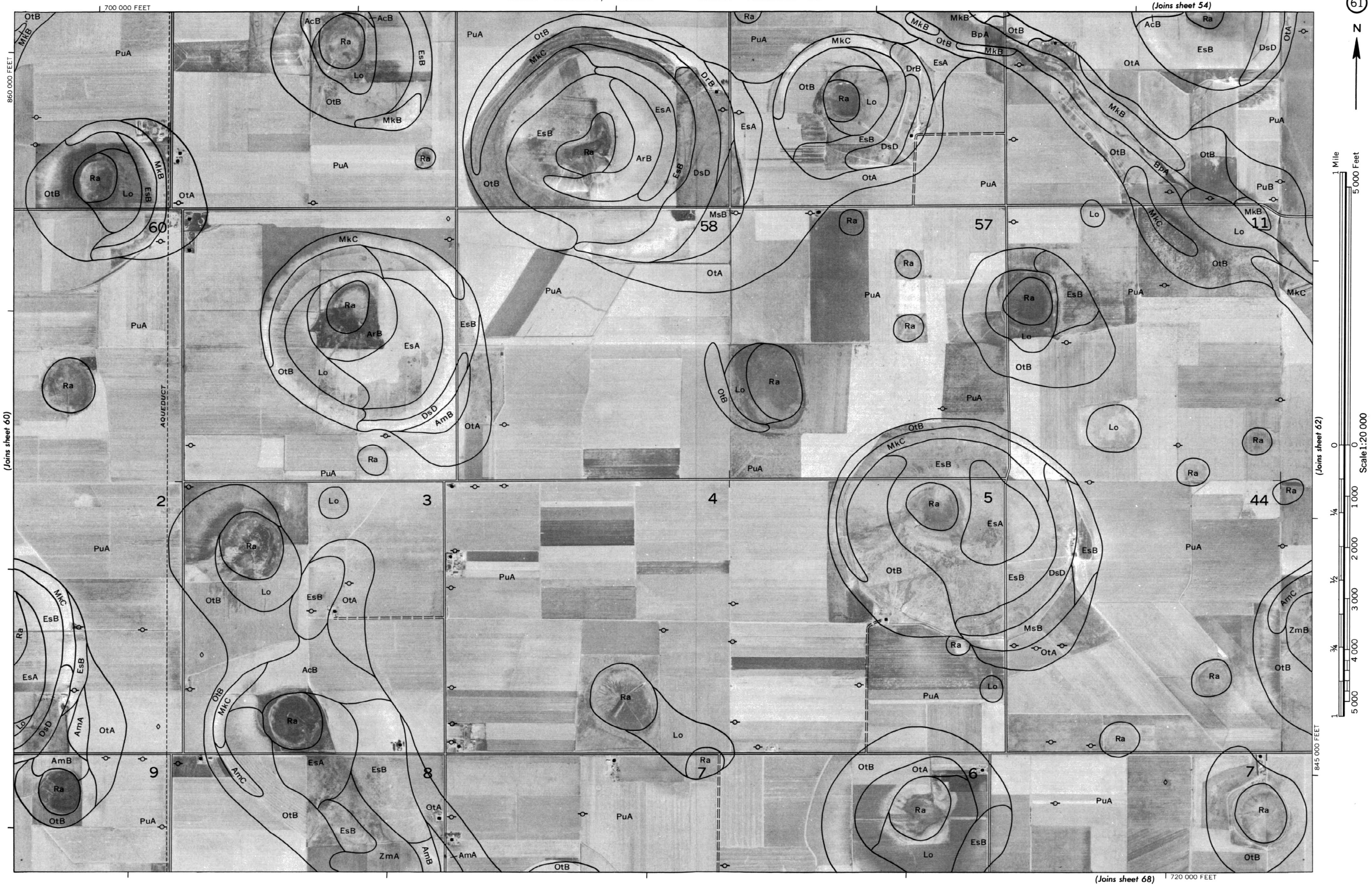
87 70 69 68 10

PuA AcB MkC MkB Lo Ra OtB OtA EsB EsA AmB ZmA DsD DrB

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.



HALE COUNTY, TEXAS NO. 61

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

N

1 Mile 5 000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

(Joins sheet 55)

(Joins sheet 61)

(Joins sheet 63)

(Joins sheet 69)

745 000 FEET

725 000 FEET

845 000 FEET

855 000 FEET

400

PuA PuB OtA AcA Ra Lo OtB EsB MkC ZmB ZmA DsD AmC

Crawfish Draw

9 10 41 46 45 48 6 5 4 3

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS — SHEET NUMBER 63

63

N

(Joins sheet 56)

750 000 FEET

855 000 FEET

(Joins sheet 62)

(Joins sheet 70)

770 000 FEET

845 000 FEET

PuA OtB Lo PuB Ra MkB EsB ArB DsD DrB EsA

42 53 52 5 6 2 47 49 51 50 1 14 13 15 16

789 37

FLOYD COUNTY

INDEFINITE BOUNDARY

FORT WORTH AND DENVER

1 Mile 5 000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

HALE COUNTY, TEXAS NO. 63

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Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

HALE COUNTY, TEXAS — SHEET NUMBER 64

64

N

Scale 1:20 000

1 Mile 5 000 Feet

0 ¼ ½ ¾ 1

5 000 4 000 3 000 2 000 1 000 0

835 000 FEET

600 000 FEET

620 000 FEET

845 000 FEET

(Joins sheet 57)

(Joins sheet 65)

(Joins sheet 71)

LAMB COUNTY

PREVIOUSLY PUBLISHED LAMB COUNTY TEXAS COUNTY BOUNDARY

Double Mountain Fork Blackwater Draw Brazos River

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

TEXAS NO. 64

HALE COUNTY, TEXAS

HALE COUNTY, TEXAS — SHEET NUMBER 65

HALE COUNTY, TEXAS NO. 65

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Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

625 000 FEET

845 000 FEET

830 000 FEET

645 000 FEET

(Joins sheet 64)

(Joins sheet 58)

(Joins sheet 66)

(Joins sheet 72)

65

N

1 Mile
5000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1
0 1 000 2 000 3 000 4 000 5 000

Blackwater Draw
Double Mountain Fork Brazos River
Blackwater Draw

14 15 3 5 17 15 3 18 16 8 9 10

(Joins sheet 59)

670 000 FEET

845 000 FEET

N

1 Mile

5 000 Feet

Scale 1:20 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

(Joins sheet 65)

(Joins sheet 67)

830 000 FEET

650 000 FEET

(Joins sheet 73)

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS NO. 66

HALE COUNTY, TEXAS — SHEET NUMBER 67

67

N

675 000 FEET

845 000 FEET

830 000 FEET

695 000 FEET

(Joins sheet 60)

(Joins sheet 66)

(Joins sheet 68)

(Joins sheet 74)

1 Mile

5 000 Feet

Scale 1:20 000

1 0 1 2 3 4 5 000

¼ ½ ¾

HALE COUNTY, TEXAS NO. 67

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

Alley

SANTA FE

TOPEKA

ATCHISON

Pumping Station

Power Plant

83 76 71 72 11

82 75 74 73 20

54 10 9 12 5

N

1 Mile
5 000 Feet
Scale 1:20 000

(Joins sheet 61)

720 000 FEET

840 000 FEET

(Joins sheet 69)

(Joins sheet 67)

830 000 FEET

(Joins sheet 75)

700 000 FEET

AQUEDUCT

Lakeview Church

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS NO. 68

HALE COUNTY, TEXAS — SHEET NUMBER 69

69

N

725 000 FEET

840 000 FEET

830 000 FEET

745 000 FEET

(Joins sheet 62)

(Joins sheet 68)

(Joins sheet 70)

(Joins sheet 76)

Crawfish Draw

1 Mile

5 000 Feet

Scale 1:20 000

HALE COUNTY, TEXAS NO. 69

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

70

HALE COUNTY, TEXAS — SHEET NUMBER 70

(Joins sheet 63)

N

1 Mile

5 000 Feet

Scale 1:20 000

(Joins sheet 69)

770 000 FEET

840 000 FEET

830 000 FEET

(Joins sheet 77)

750 000 FEET

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS NO. 70

Draw

Crawfish

DENVER AND FORT WORTH

FLOYD COUNTY

INDEFINITE BOUNDARY

Petersburg

13 14 15 16 17 18 19 20 17½ 8 11

PuA Lo Ra OtA OtB MkB MkC EsA EsB DrB DsD ArB ZmA PuB

HALE COUNTY, TEXAS — SHEET NUMBER 71

600 000 FEET

830 000 FEET

815 000 FEET

620 000 FEET

(Joins sheet 64)

(Joins sheet 72)

PREVIOUSLY PUBLISHED LAMB COUNTY TEXAS COUNTY BOUNDARY

LAMB COUNTY

HOCKLEY CO

LUBBOCK COUNTY

71

N

1 Mile

5 000 Feet

Scale 1:20 000

HALE COUNTY, TEXAS NO. 71

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

N

Scale 1:20 000

1 Mile 5 000 Feet

0 0 ¼ 1 000 ½ 2 000 ¾ 4 000 1 5 000

(Joins sheet 65)

(Joins sheet 71)

(Joins sheet 73)

645 000 FEET

825 000 FEET

815 000 FEET

625 000 FEET

Double Mountain Fork Brazos River

Blackwater Draw

County Line

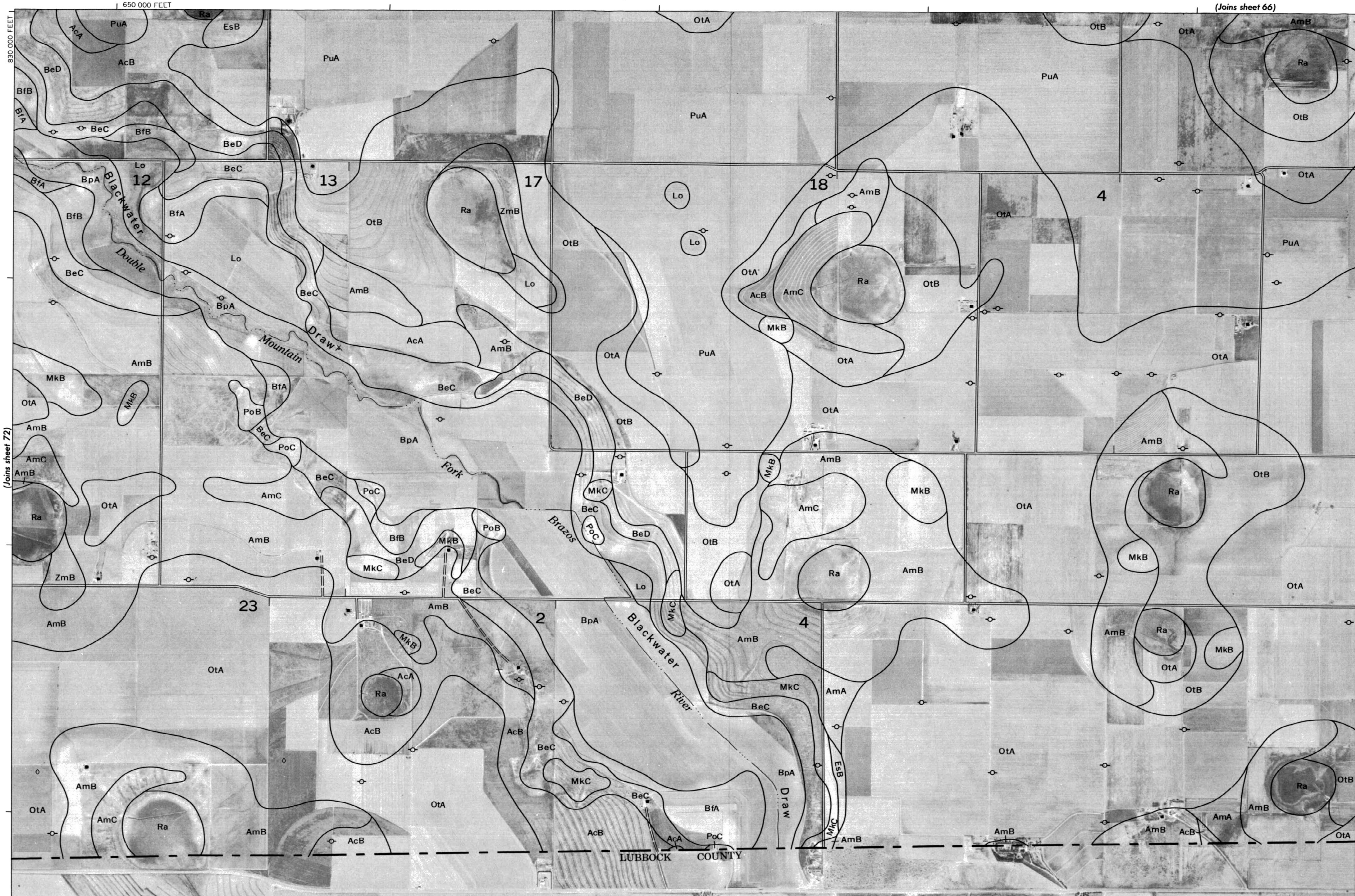
LUBBOCK COUNTY

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS NO. 72



N

Scale 1:20 000

1 Mile

5 000 Feet

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

74

HALE COUNTY, TEXAS — SHEET NUMBER 74

N

(Joins sheet 67)

695 000 FEET

825 000 FEET

1 Mile

5 000 Feet

Scale 1:20 000

(Joins sheet 73)

(Joins sheet 75)

815 000 FEET

675 000 FEET

AmB AmC AcA AcB DsD EsA EsB Lo MkB MkC MsB OtA OtB PoB PoC PuA Ra

3 1 11 8 7 10 12 14

ABERNATHY

IOOF CEMETERY

ATCHISON TOPEKA AND SANTA FE

LUBBOCK COUNTY

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

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HALE COUNTY, TEXAS NO. 74

HALE COUNTY, TEXAS — SHEET NUMBER 75

HALE COUNTY, TEXAS NO. 75

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.

700 000 FEET

825 000 FEET

815 000 FEET

720 000 FEET

(Joins sheet 68)

(Joins sheet 74)

(Joins sheet 76)

75

N

1 Mile

5 000 Feet

Scale 1:20 000

PEARCE CHAPEL CEMETERY

ABERNATHY AIRPORT

GOLF COURSE

AQUEDUCT

LUBBOCK COUNTY

(Joins sheet 69)

N

745 000 FEET

825 000 FEET

1 Mile

5 000 Feet

Scale 1:20 000

(Joins sheet 75)

(Joins sheet 77)

815 000 FEET

725 000 FEET

LUBBOCK COUNTY

PuA 1

2

3

4

5

6

7

20

143

144

Land division corners are approximately positioned on this map.

Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

HALE COUNTY, TEXAS NO. 77

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1970 aerial photography. Positions of grid ticks are approximate and based on the Texas coordinate system, north central zone.
Land division corners are approximately positioned on this map.